AD-A154 329 NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS 1/2
ELLIS POND DAM (MA 00.. (U) CORPS OF ENGINEERS WALTHAM
MA NEW ENGLAND DIV JUL 79

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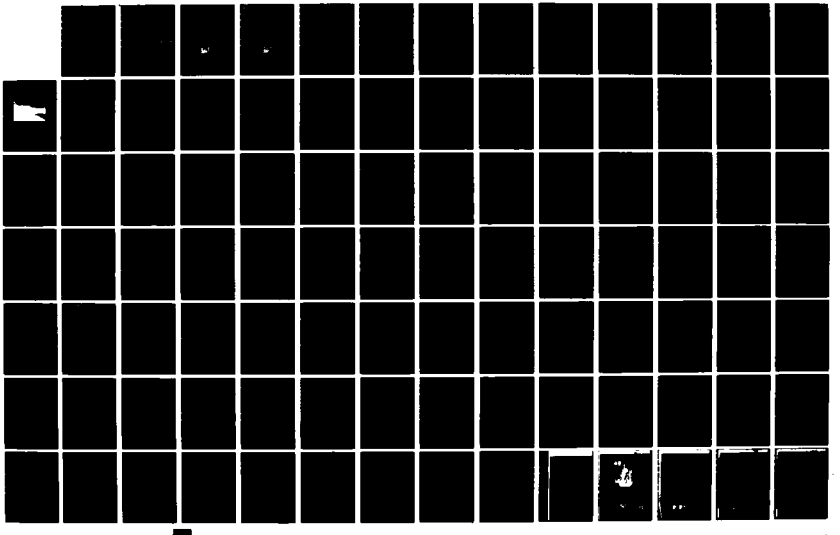

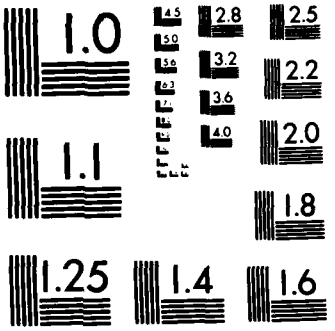

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NORWOOD, MASSACHUSETTS

ELLIS POND DAM
MA 00805

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

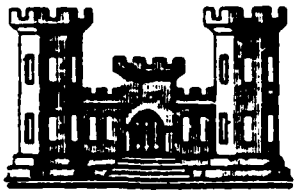
DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS. 02154

JULY 1979

MASSACHUSETTS COASTAL BASIN
NORWOOD, MASSACHUSETTS

ELLIS POND DAM
MA 00805

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM



DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS. 02154

JULY 1979

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19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

DAMS, INSPECTION, DAM SAFETY,

Massachusetts Coastal Basin
Norwood, Massachusetts
Hawes Brook

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The dam is an earth dam about 400 ft. long and 16 ft. high. It is small in size with a high hazard potential. Generally, it is in poor condition. Many deficiencies which have been neglected for years were noted. In the event of failure of the dam there is an extent of downstream development that would be seriously affected.

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MASSACHUSETTS COASTAL BASIN
NORWOOD, MASSACHUSETTS

ELLIS POND DAM
MA 00805

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS. 02154

JULY 1979

PHASE I INVESTIGATION REPORT
NATIONAL DAM INSPECTION PROGRAM

Identification No.:	MA 00805
Name of Dam:	Ellis Pond
Town:	Norwood
County:	Norfolk
State:	Massachusetts
Stream:	Hawes Brook
Date of Site Visit:	14 May 1979

BRIEF ASSESSMENT

Ellis Pond Dam is an earth dam approximately 400 ft. long and 16 ft. high. There are two small stoplog-controlled spillways, one near each abutment, and no low-level outlet. Formerly used as a mill dam, the structure is believed to be about 170 years old. Ellis Pond is presently used for recreational purposes.

Due to the extent of downstream development that would be seriously affected in the event the dam were to fail, Ellis Pond Dam is confirmed as having a "high" hazard potential in accordance with Corps of Engineers guidelines.

The dam is in poor condition, based on visual examination of the structure. Many deficiencies which have been neglected for years were noted. In 1968, the Norfolk County Commissioners directed that the pond be partially drained since the dam was considered unsafe. However, the pond level has been raised again since 1974 despite this directive. Therefore, although there was no evidence of settlement, lateral movement or other signs of structural failure, it is recommended that the stoplogs be removed from the spillways immediately and kept removed to lower the pond as a precaution until further engineering studies and remedial measures are implemented.

Based on the "small" size and "high" hazard potential classifications in accordance with Corps of Engineers guidelines, the test flood for this dam is one-half the Probable Maximum Flood (1/2 PMF). Hydraulic analyses indicate that the test flood outflow of 2,700 cfs (inflow 3,000 cfs or 375 csm) would overtop the dam by

about 1.3 ft. With the water level at the top of dam, the combined spillway capacity is approximately 625 cfs with the existing stoplogs in place and 760 cfs with the stoplogs removed or 23 and 28 percent of the test flood outflow, respectively.

The Town of Norwood, owner of the dam, should engage a registered professional engineer to evaluate the spillways during no or low flow conditions and recommend modifications to the dam to provide adequate structural stability, spillway capacity and emergency draw-down capabilities, as outlined in Section 7.2. Any necessary modifications resulting from the engineering investigations, and remedial measures, including clearing trees, brush, and debris from the embankment, spillways and channels, repairing riprap and masonry, developing an operations and maintenance manual for the dam and establishing an emergency preparedness plan and warning system, as outlined in Section 7.3, should be implemented by the Owner within one year after receipt of this report. As an alternative to modifying and repairing the inadequate existing structure, serious consideration should be given to constructing a new dam at the site.

HALEY & ALDRICH, INC.
by:

Harl Aldrich
President

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the office of Chief of Engineers, Washington, DC 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I Investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I Investigations are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the test flood is based on the estimated "probable maximum flood" for the region (greatest reasonably possible storm run-off), or a fraction thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential. Consideration of downstream flooding other than in the event of a dam failure is beyond the scope of this investigation.

The Phase I Investigation does not include an assessment of the need for fences, gates, no-trespassing signs, repairs to existing fences and railings and other items which may be needed to minimize trespass and provide greater security for the facility and safety to the public. An evaluation of the project for compliance with OSHA rules and regulations is also excluded.

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1. Overview of Ellis Pond Dam, upstream side

DAM: Ellis Pond	**LOCATION MAP**
IDENTIFICATION NO. MA 00805	**USGS QUADRANGLE**
	NORWOOD, MA
	APPROX. SCALE: 1" = 2000'

FILE NO. 4270 A30

PHASE I INVESTIGATION REPORT
NATIONAL DAM INSPECTION PROGRAM
ELLIS POND DAM
MA 00805

SECTION 1 - PROJECT INFORMATION

1.1 General

a. Authority. Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a National Program of Dam Inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region.

Haley & Aldrich, Inc. has been retained by the New England Division to inspect and report on selected dams in the State of Massachusetts. Authorization and notice to proceed were issued to Haley & Aldrich, Inc. under a letter dated 28 November 1978 from Colonel Max B. Scheider, Corps of Engineers. Contract No. DACW33-79-C-0018 has been assigned by the Corps of Engineers for this work. Camp, Dresser & McKee, Inc. was retained as consultant to Haley & Aldrich, Inc. on the structural, mechanical/electrical and hydraulic/hydrologic aspects of the Investigation.

b. Purpose of Inspection. The primary purposes of the National Dam Inspection Program are to:

1. Perform technical inspection and evaluation of non-Federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-Federal interests.

2. Encourage and prepare the states to initiate effective dam safety programs for non-Federal dams.

3. Update, verify and complete the National Inventory of Dams.

1.2 Description of Project

a. Location. Ellis Pond Dam is located about 250 ft. northwest of Walpole Street (Route 1A) in Norwood, Massachusetts, as shown on the Location Map, page vii. The latitude and longitude of the dam site are N42°10.8' and W71°13.2'. Discharge from the dam is conveyed by Hawes Brook, a tributary to the Neponset River.

b. Description of Dam and Appurtenances. Ellis Pond Dam consists of an earth embankment with two stop-log-controlled spillways, one near each abutment. The total length of the dam is nearly 400 ft., and its maximum height is about 16 ft. The general configuration of the project, based on visual observations made on 14 May 1979, is shown on the Site Plan Sketch, page C-1.

The earth embankment between the two spillways measures 284 ft. in length. The top of the embankment (top of dam) is considered to be at El. 116.5 National Geodetic Vertical Datum (NGVD), although local variations from about El. 116.2 to El. 117.2 were roughly measured. The crest varies in width from about 12 ft. near the right (west) spillway to a maximum of 27 ft. There are generally large boulders 1/4 to 1/2 cubic yards in size on the steep upstream slope. The downstream side was apparently once supported by a stone masonry wall that has toppled at many locations, causing a steep and highly irregular downstream slope to develop. The embankment and abutments are shown on Photos No. 2, 3, 4, 5, and 8 in Appendix C.

Additional information regarding the earth embankment was available in an extensive engineering report prepared by Fay, Spofford & Thorndike, Inc. entitled "Planning Study, The Ellis Pond - Guild Pond Recreation Area", 10 April 1973. Pertinent sections from this report, including a site plan with boring locations, a topographic plan of Ellis Pond Dam and the logs of seven test borings performed at the dam site, are included in Appendix B. The conclusions drawn from the results of the borings by Fay, Spofford & Thorndike, Inc. in their report (see page B-27) were that "Exploratory borings taken through and around the dam indicate a strata of rock three to ten feet below ground water level. They show that the embankment was constructed with pervious materials without an

impervious core and they also show that it is quite likely that there was no excavation to bedrock prior to placement of the embankment."

The spillway near the right (west) abutment of the dam has a 10.2 ft. long weir between 5.0 ft. high concrete walls at the upstream end. Two stoplogs in place on 14 May 1979 raise the crest of the spillway by 1.0 ft. to El. 112.5 or approximately 4.0 ft. below the top of the dam. The downstream end of the spillway is of grouted stone masonry construction. A 12-in. diameter vetrified clay pipe emerges from the right wall of the spillway at the top of a straight drop (cascade) of about 10.5 ft. to the brook below. This spillway is shown on Photos No. 3, 6 and 7.

The spillway located near the left (east) abutment has grouted stone masonry walls. Three vertical supports for stoplogs reduce the 12.5 ft. overall length of the weir to an effective length of 11.2 ft. Several stoplogs in place in the four bays on 14 May 1979 raise the crest of the spillway by 2.4 ft. to El. 112.3 or approximately 4.2 ft. below the top of dam. This spillway is shown on Photos No. 8 through 11.

c. Size Classification. The storage to the top of Ellis Pond Dam is estimated to be 540 acre-ft., and the corresponding hydraulic height of the dam is approximately 16.0 ft. Storage of less than 1,000 acre-ft. and a height of less than 40 ft. classifies this dam in the "small" size category according to guidelines established by the Corps of Engineers.

d. Hazard Classification. The preliminary computations for dam failure analysis, presented in Appendix D and based on the Corps of Engineers' "Guidance for Estimating Downstream Dam Failure Hydrograph", confirm that this dam has a "high" hazard potential. A failure of the earth embankment would result in a potential for loss of life to shoppers and employees at the nearby downstream shopping center, to those at the apartments on the left (northeast) bank, and to motorists and pedestrians using the Walpole Street bridge. In addition, several industrial buildings near Davis Avenue, about 2,000 ft. downstream from the dam, are expected to be subject to flooding at a depth of about

8 ft. Therefore, the potential for loss of lives and extensive damage to industrial, commercial and residential properties is high.

e. Ownership. The name, address and phone number of the current owner are:

Town of Norwood
Board of Selectmen
Municipal Building
566 Washington Street
Norwood, MA 02062
Phone: (617) 762-1240

The earliest recorded owner of the dam was the Abner Guild Tannery in 1806, followed by the Winslow Bros. & Smith Tannery. Mr. Isaac Ellis operated paperboard manufacturing mills at the dam site until they burned down in 1886. In recent times, Forte-Fairbairn, Inc. (Trustees of Davis Building Trust) was the former owner before the Town of Norwood acquired the property in 1973 for conservation purposes.

f. Operator. No particular individual is designated as the operator of the dam. Mrs. Bettrica S. Cottrell is the chairperson of the Norwood Conservation Commission, charged with maintaining and operating the dam. Mr. Robert Hamilton, Town Engineer, advises the Conservation Commission upon request. These two individuals acted as the owner's representatives during the course of this investigation.

g. Purpose of the Dam. The earliest recorded use of the dam was to impound water for tanneries in the early 1800's. The impounded water was also reportedly used to power a 40-horsepower water wheel at the dam site by the Ellis Mills in the mid-1800's. It is also likely that the pond was once used as a source of supply for manufacturing ice. The pond is currently used for ice-skating, fishing, canoeing and other recreational purposes by Norwood residents.

h. Design and Construction History. No records of the original design and construction of the dam exist. The dam may be over 170 years old.

i. Normal Operational Procedures. No formal

operational procedures for Ellis Pond Dam were disclosed. Stoplogs were observed at both spillways on 14 May 1979, holding the pond level at El. 112.7 or slightly higher than its normal recreational level of about El. 112.5. It was reported and noted in previous reports that there have been instances of unauthorized installation of stoplogs at this facility. It appears that the pond level observed during the site visit was higher than the authorized elevation for the following reasons:

In a letter from the County of Norfolk Engineering Department to the Norfolk County Commissioners dated 15 July 1968 (see page B-3), it is stated that "... the condition of the dam is such that it cannot be considered to be safe and in good condition. Its overall condition is poor and in some areas dangerous conditions exist." In the February 1972 report by the Soil Conservation Service (see page B-16) the following statements appear: "In compliance with the County Commissioners' directive, the pond has been partially drained since the dam was considered unsafe. This draining has exposed much of the gently sloping shoreline and has reduced the value of the pond for recreational uses." It is stated in the Fay, Spofford & Thorndike, Inc. engineering report dated 10 April 1973 (see page B-26) that the stoplogs "... have since been removed in order to maintain a safe level in the pond." At that time the pond level was El. 110.5 with no stoplogs in the spillways.

The first report of unauthorized installation of stoplogs in the spillways was in 1974, after the pond level had apparently been raised back up to its normal recreational level of about El. 112.5. In a letter to the Norwood Board of Selectmen from the Massachusetts Department of Public Works dated 9 October 1974 (see page B-6), it was recommended that the stoplogs be removed as a safety precaution in the event of possible high water conditions. It is not clear what actions, if any, the Town of Norwood has taken to prevent the unauthorized installation of stoplogs in the spillways since 1974.

1.3 Pertinent Data

All elevation reported herein are approximate and based on the assumption that the level of Ellis Pond was El. 112.7 NGVD on 14 May 1979. The pond level

was 1.2 ft. higher than the right (west) spillway bottom immediately upstream of the stoplogs, which is shown to be El. 111.48 on a topographic plan of the dam by Fay, Spofford & Thorndike, Inc., page B-31. Other roughly measured elevations are in close agreement with those shown on that topographic plan.

a. Drainage Area. Ellis Pond Dam is located on Hawes Brook, a tributary to the Neponset River. The drainage area is 8 square miles, consisting of rolling hills with some developed residential land and some low-lying swamp lands and water bodies. Most significant among the water bodies is Willett Pond, which drains to Guild Pond and then to Ellis Pond.

b. Discharge at Dam Site

1. Outlet works.....	None
2. Maximum known flood at dam site.....	Unknown. The dam has been overtopped by hurricane "Diane" in August 1955
3. Ungated spillway capacity at top of dam	
(without stoplogs).....	760 cfs at El. 116.5
(with existing stoplogs).....	625 cfs at El. 116.5
4. Ungated spillway capacity at test flood pool elevation	
(without stoplogs).....	845 cfs at El. 117.8 (1,855 cfs passing over earth embankment)
(with existing stoplogs).....	940 cfs at El. 117.8 (1,760 cfs passing over earth embankment)
5. Gated spillway capacity at normal pool elevation.....	Not applicable
6. Gated spillway capacity at test flood pool elevation....	Not applicable
7. Total spillway capacity at test flood pool elevation	
(without stoplogs).....	845 cfs at El. 117.8 (dam overtopped by 1.3 ft.)

(with existing stoplogs)..... 940 cfs at El. 117.8 (dam overtopped by 1.3 ft.)

8. Total project discharge at test flood pool elevation
   (without stoplogs)..... 2,700 cfs at El. 117.8 (dam overtopped by 1.3 ft.)
   (with existing stoplogs)..... 2,700 cfs at El. 117.8 (dam overtopped by 1.3 ft.)

c. Elevation (ft. above NGVD)

1. Streambed at centerline of dam..... 100.5 at right spillway
2. Maximum tailwater..... Unknown
3. Upstream portal invert diversion tunnel..... Not applicable
4. Recreation pool..... 112.5
5. Full flood control pool..... Not applicable
6. Right (west) spillway crest
   (without stoplogs)..... 111.5
   (with stoplogs)..... 112.5 on 14 May 1979
   Left (east) spillway crest
   (without stoplogs)..... 108.5 (higher upstream
   (with stoplogs)..... 112.3 on 14 May 1979
7. Design surcharge - original design..... Unknown
8. Top of dam..... 116.5
9. Test flood design surcharge.. 117.8

d. Reservoir

1. Length of maximum pool..... 0.38 mi. (Est.)
2. Length of recreation pool.... 0.34 mi. (Est.)
3. Length of flood control pool. Not applicable

e. Storage (acre-feet)

1. Recreation pool..... 275
2. Flood control pool..... Not applicable
3. Spillway crest..... 275
4. Top of dam..... 540
5. Test flood pool..... 650

f. Reservoir Surface (acres)

1. Recreation pool	37
2. Flood control pool	Not applicable
3. Spillway crest	37
4. Top of dam	72
5. Test flood pool	87

g. Dam

1. Type	Earth embankment
2. Length	Measured 284 ft. between spillways
3. Height	Maximum about 16 ft.
4. Top width	12 to 27 ft.
5. Side slopes	U/S, 1H to 1V (irregular); D/S highly variable
6. Zoning	Reportedly none
7. Impervious core	Reportedly none
8. Cutoff	Reportedly not to bedrock
9. Grout curtain	Unlikely
10. Other	Stone wall on D/S side toppled at many locations

h. Diversion and Regulating Tunnel. Not applicable

i. Spillway

1. Type	Two spillways, both gravity overflow, stone masonry with stoplogs
2. Length of right (west) weir	10.2 ft.
Length of left (east) weir	11.2 ft. unobstructed
3. Crest elevation (with stoplogs)	112.5, right weir 112.3, left weir
4. Gates	None
5. U/S channel	Not visible
6. D/S channel	Right (west) channel is confined by stone walls and flows straight to Walpole Street; left (east) channel banked with loose stones, curves

toward Walpole
Street and has
a series of steps
down from stoplogs

j. Regulating Outlets. The pond elevation is regulated by two spillways which are controlled by stoplogs. The left (east) spillway is about 12.5 ft. long and 8.5 ft. high with an invert of El. 108.5 without stoplogs (approach channel invert may be as high as El. 110.5). Effective spillway opening is reduced to 11.2 ft. because of three vertical stoplog supports, each approximately 0.5 ft. wide. The right spillway is 10.2 ft. long and 5 ft. high with an invert of El. 111.5 ft. without stoplogs. There was no pond drain disclosed during the site visit.

It should be noted that in Fay, Spofford & Thorndike, Inc. report dated 10 April 1973, it is reported that an attempt to remove the stoplogs during the August 1955 hurricane "Diane" was unsuccessful.

SECTION 2 - ENGINEERING DATA

2.1 Design Data

No design data for the existing dam are available. However, at least three engineering studies have been performed since 1966 that include specific recommendations for increasing the spillway capacity at the dam site, based on preliminary hydrologic and hydraulic computations. The most recent of these reports, dated 10 April 1973, includes design recommendations for a proposed new dam that would incorporate the existing dam in the downstream portion.

2.2 Construction Data

No engineering data documenting the original construction or any post-construction changes in the existing dam are available. The results of several test borings performed at the dam and surrounding area in November 1972 and a topographic plan of the dam are included in the 10 April 1973 engineering report.

2.3 Operation Data

Prior county and state inspection reports and several engineering evaluation reports are the only operation records disclosed for this dam.

2.4 Evaluation of Data

a. Availability. A list of the engineering data available for use in preparing this report is included on pages B-1 and B-2. Selected documents from the listing are also included in Appendix B.

b. Adequacy. There was a total lack of original design and construction data, but a considerable amount of recent engineering evaluation data available to aid in the evaluation of Ellis Pond Dam. This Phase I assessment was therefore based primarily on visual examination, preliminary hydraulic and hydrologic computations, consideration of past performance and application of engineering judgement.

c. Validity. The information contained in the engineering data may generally be considered valid. It was noticed that certain dimensions of the dam vary somewhat from one report to another. For example, the maximum height of the dam is given as 20 ft. rather than 16 ft. in the state inspection report dated 16 September 1974. The spillway dimensions are also not always accurately given in the engineering data. For example, the length of the right (west) spillway is 10.2 ft., not 5 ft. as appears in the Soil Conservation Service and Fay, Spofford and Thorndike, Inc. reports.

SECTION 3 - VISUAL EXAMINATION

3.1 Findings

a. General. The Phase I visual examination of Ellis Pond Dam was conducted on 14 May 1979. The upstream water surface elevation was determined to be El. 112.7, which is 3.8 ft. below the top of dam.

In general, the project was found to be in poor condition. Major deficiencies which require correction were noted. The dam has deteriorated due to its age and lack of proper maintenance.

A visual inspection check list is included in Appendix A and selected photographs of the project are given in Appendix C. A "Site Plan Sketch", page C-1, shows the direction of view for each photograph.

b. Dam. The earth embankment between the two spillways is in poor condition. Although the owner had recently cut brush on the crest of the embankment, the remaining vegetation, especially on the downstream side, made the visual examination extremely difficult and less than thorough. The following specific items were noted:

1. The upstream slope is very irregular in appearance, Photos No. 1 and 2. Numerous large boulders serve as slope protection, but are missing in some locations. The boulder slope is steep above the present pond level, varying from near vertical to about 1 horizontal to 1 vertical towards the left end. There is active erosion of the slope for a distance of about 8 ft. left from the right (west) spillway, Photo No. 3. The boulders in this area have collapsed into the pond. Immediately to the right of the left spillway, there is another area of active erosion with no boulder protection where a stone masonry retaining wall had been in 1973 (compare present condition with topographic plan, page B-31).

   The largest tree on the upstream slope is

4 in. diameter birch located at the water line approximately midway between the two spillways. Otherwise the dense brush, either remaining or having recently been cut, is generally less than 1-in. diameter on the upstream slope.

2. The embankment crest is generally covered by grass, weeds and recently cut low brush, Photo No. 4. There are no trees on the top of the embankment. However, the partially rotted stumps of two trees observed at the locations shown on page C-1 are evidence that large trees once grew on the dam. The vertical alignment of the crest varies by about 1 ft., being lowest immediately adjacent to the spillways. No animal holes, cracks or unusual settlement were observed across the top of the dam. The variable width of the embankment crest is due mainly to sloughing in areas where the downstream wall has collapsed.

3. It was virtually impossible to examine the downstream side of the dam because of the steepness of the slope and the dense brush and poison ivy. It appears that this side is partially retained by a stone wall. About 10 ft. left of the right (west) spillway, the wall has either collapsed or was constructed as a long low stone masonry wall about 4 ft. in height, Photo No. 5. Sections of large diameter tree truck were scattered on the steep slope above the wall, which extends to the left at least 40 ft. from the spillway. Beyond the toe, especially at the center and left end, the area is wet and swampy with skunk cabbage. Approximately 100 ft. right of the left spillway, where a decaying 15-in. diameter tree stump was observed at the top of the slope, the stone wall appears to have collapsed into the marshy area below. Approximately 120 ft. left of the right (west) spillway, cobbles and boulders have been placed to form a slope about 1.5 horizontal to 1 vertical. It was wet and swampy with skunk cabbage

below this section also. There are no trees of significant size on the downstream slope. However, immediately along the toe of the dam there are several large oak trees. Overall, the downstream side of the dam is very irregular, both in topography and surface material.

4. The right abutment of the dam occurs immediately beyond the right (west) spillway, where there is no threat to the safety of the dam. There is a stone masonry retaining wall on the downstream side of the abutment, starting at the spillway, Photo No. 7. Approximately 20 ft. from the spillway this wall has collapsed and become a path from the top of the dam to the downstream channel. The area left of the left (east) spillway appears to be natural ground with little potential for failure, Photo No. 8. Bedrock outcrops at the downstream toe of the left spillway.

c. Appurtenant Structures. Two spillways control the flow of water at the dam site.

At the right (west) abutment of the dam is a stoplog-controlled spillway about 10 ft. long by 5 ft. high, Photo No. 3. There were two wooden stoplogs in place at the time of the site visit, Photo No. 6. The bottom of the spillway channel is flat for the first 23.6 ft. and then drops vertically to the brook approximately 10.5 ft. below the spillway channel. The bottom of the spillway channel and the face of the vertical drop were obscured from view by a heavy flow of water, Photo No. 7.

The upstream portion of the spillway (the first 14 ft. length of the side walls) is constructed of concrete found to be in good condition with some minor surface erosion and staining observed, Photo No 6. Otherwise, the spillway walls are constructed of grouted stone masonry. The stone masonry above the spillway channel floor is generally in good condition with some vine growth developing over the surface. A vertical crack in the stone masonry of the right wall immediately above a 12-in. diameter vetrified clay pipe (which is

above the cascade into the brook) extends to the top of the wall, Photo No. 7. Some joint erosion was observed at the floor level upstream of the drop. The remaining portions of the stone masonry walls downstream of the drop are in poor condition with extensive loss of grout from the joints. A large vertical crack was observed running the full height of the stone masonry wall at the downstream end of the left spillway wall, Photo No. 5.

At the left (east) abutment of the dam is a 12.5 ft. long by 8.5 ft. high spillway also controlled by stoplogs, Photo No. 8. The spillway has grouted stone masonry walls approximately 37 ft. in length with a stepped cascade downstream of the stoplogs. Approximately 14 ft. from the entrance of the spillway are four bays of stoplogs with wide flanged stoplog guides supported at the top with a steel channel. The stoplog guides and support channel are in good condition, Photos No. 9 and 10. About four feet of stoplogs were in place with some leakage between them apparent. The floor of the spillway and the stoplogs were obscured from view by a heavy flow of water, Photo No. 11.

The stone masonry walls are in fair to poor condition with extensive loss of grout at the bottom portion of the walls for the full length of the spillway. Water was observed flowing from the wall joints downstream of the stoplogs, Photos No. 9 and 10. Water was also flowing from the downstream ends of both walls, Photo No. 11, indicating that water in the spillway is flowing through the joints and under the walls.

The first step of the cascade, although obscured by water, appears to be of concrete and/or grouted stone masonry. The remaining steps appear to be pools formed by wooden logs placed across the spillway and embedded in the channel walls. There was a tremendous amount of debris hung up in these pooled steps, Photo No. 11.

d. Reservoir Area. Ellis Pond is located in a highly developed urban area. There are over twenty homes surrounding the pond, as shown on a site plan included as page B-30. The topography of the area is relatively flat. The shoreline generally consists

of lawns and wooded areas. There is no significant probability of landslides into the reservoir affecting the safety of the dam. Siltation has reportedly reduced the depth of the pond considerably.

e. Downstream Channel. Ellis Pond is located on Hawes Brook which, in turn, flows into the Neponset River. The distance from Ellis Pond Dam to the confluence of Hawes Brook with the Neponset River is approximately 1.2 miles. The reach of the channel investigated for this study extends from Ellis Pond Dam 0.6 miles downstream to a railroad embankment. The channel ranges from 10 to 15 ft. in width and between 3 and 5 ft. in depth.

The channel itself is split into two branches from the dam to Walpole Street. The right (west) branch is defined by mortarless stone wall banks, Photo No. 12, whereas the left (east) branch is less clearly defined by scattered loose stones along the banks. The area between the branches is thickly vegetated by grasses, vines, bushes and large trees. The two branches of the brook join on the upstream side of Walpole Street, shown on the site plan included as page B-30. Note that there is normally no access to the earth embankment to the dam other than by foot across the downstream channels or by boat.

Walpole Street (Route 1A) is a two-lane highway passing over Hawes Brook approximately 500 ft. downstream from the dam. The channel beneath the street consists of two stone arch culverts as shown on the drawing included as page B-30. Below Walpole Street, Hawes Brook passes over a small weir and through an industrial and warehousing area characterized by two motor vehicle bridges, two footbridges, a railroad (spur) bridge and a factory building that straddles the brook. The channel banks are marked by loose stones downstream to the industrial and warehouse area, through which Hawes Brook passes in a channel having a stone wall bank on both sides. Thereafter to the railroad embankment, the channel is again formed by loose stones.

The stream bottom is stony and, in places, contains trash and vegetative debris. The trash and

debris appear to be concentrated primarily at and below the dam and at the industrial area. The slope of the stream bottom ranges between 0.003 and 0.016, the higher slope being closest to the dam and the lower slope being near the railroad embankment.

3.2 Evaluation

Based on the visual examination conducted on 14 May 1979, Ellis Pond Dam is in poor condition. Serious deficiencies which, if left uncorrected, may result in a catostrophic failure of the dam were noted. The dam has deteriorated with time and does not receive adequate maintenance.

With regard to the earth embankment, there is a lack of riprap protection on the upstream slope adjacent to the two spillways, and active erosion is occurring in these areas. The stone wall on the downstream side has collapsed in many places, allowing sloughing of the embankment crest which is reducing the cross-section of the dam. Seepage through the embankment is obvious by the wet areas and swampy vegetation at the downstream toe. Heavy brush growth on the slopes, toe and downstream of the dam made close visual examination virtually impossible. Reportedly, many large trees growing on the embankment throughout is length were cut down in 1973 or 1974, but the owner failed to have the stumps removed. Consequently, the decaying stumps and major root systems could contribute to seepage through the embankment and possibly cause failure of the dam due to piping.

The downstream portions of the stone masonry walls of the right (west) spillway are considered to be poor due to extensive deterioration of joints and the observed vertical cracks. The large vertical crack in the wall on the left side of the spillway indicates the possibility of structural instability occuring some time in the past but has since stablized. The walls of the left (east) spillway are also considered to be in poor condition due to the joint deterioration and the channel flow below the downstream training walls. Debris accumulated in the spillway and channel has reduced the spillway capacity.

While both spillways appear to be performing

adequately at the present time, the conditions of the walls offer potential for further deterioration under conditions of heavy flow, especially at the area of the large vertical crack in the right spillway. Similarly, an increase in the channel wall flow under the downstream walls of the left spillway is possible and would certainly be undesirable.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 Procedures

In general, there are no formal procedures to provide routine maintenance and satisfactory operation of the dam.

Stoplogs observed in place at the spillways on 14 May 1979 are reportedly not authorized by the Town of Norwood, as discussed in Section 1.2 i of this report.

4.2 Maintenance of Dam

There are no established procedures or manuals for inspection and maintenance of the dam. The owner reportedly attempts to maintain the dam with limited funds. Prior to the site visit on 14 May 1979, brush had been cut on the crest of the embankment. The only other recent maintenance performed was the cutting down of large trees on the embankment in 1973 or 1974.

4.3 Maintenance of Operating Facilities

There was no formal procedures for maintenance of the operating facilities disclosed for this dam. The observed condition of the facility and the deficiencies noted during the site visit are similar in nature to those indicated in past reports, thus indicating that little to no maintenance has been performed at this facility.

4.4 Description of any Warning System in Effect

There is no warning system or emergency preparedness plan in effect for this structure.

4.5 Evaluation

The owner should prepare an operations and maintenance manual for the dam. The manual should delineate the routine operational procedures and maintenance work to be done on the dam to provide satisfactory operation and minimize deterioration of the facility. For example, an annual observation and maintenance program should

be established to examine the dam, control vegetation growth and maintain slopes, walls and channels. A formal procedure should be established to prevent the unauthorized insertion of stoplogs from raising the pond level higher than the authorized level.

Since failure of the dam would probably cause loss of life and extensive property damage downstream, the owner should also prepare and implement a formal emergency preparedness plan and warning system.

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. General. Two quite extensive engineering evaluations of Ellis Pond Dam have been recently performed. One report is entitled "Reconnaissance Report, Ellis Pond", February 1972, by the Soil Conservation Service of the U.S. Department of Agriculture (referred to herein as "the SCS report"); and the other was performed in 1973 as a follow up to the SCS report by the engineering firm of Fay, Spofford & Thorndike, Inc. entitled "Planning Study, The Ellis Pond - Guild Pond Recreation Area" (referred to herein as "the FST report"). Both of these reports were instigated by efforts of the Norwood Selectmen to restore the dam as well as Ellis and Guild Ponds for recreational facilities improvements. (Guild Pond is upstream from Ellis Pond.)

The SCS and FST reports conclude that there is a need for replacing the existing two spillways at Ellis Pond with one long spillway so that a flood flow with 100-year return period could be adequately accommodated. According to the FST report, the present spillways neither have the desired flood control capacity nor do they have acceptable structural integrity. No data on the actual design flow were available.

b. Design Data. No hydrologic or hydraulic design data were available for this existing dam.

c. Experience Data. The FST report cites two recent storms that caused pond water to overtop the left (east) spillway bank. These two storms occurred in 1955 (Hurricane "Diane") and in 1968. During these storms, the owner was unable to remove any stoplogs because of the pressure of the pond water pushing against the dam.

Following the 1968 storm, the Norfolk County Commissioners ordered that the stoplogs be lowered. In 1974, the removed stoplogs were replaced without proper authority. The Town of Norwood is aware of

this problem, but it is not clear what action they have taken to prevent persons unknown from raising the pond level in this manner. In any case, the stoplogs apparently are being replaced such that the pond is kept at its normal recreational level.

There are no flow records available for this dam.

d. Visual Observations. The dam consists of two spillways separated by an earth embankment approximately 284 ft. long. The right (west) spillway is constructed of concrete at the upstream end next to the pond and stone masonry downstream. The left (east) spillway is constructed entirely of stone masonry. Water surface elevation is controlled by the number of stoplogs which are presently left installed in the spillways. The water surface elevation on the day of the site visit was 0.2 ft. above the right spillway and 0.4 ft. above the left spillway. The earth embankment between the two spillways is covered with a low growth of bushes and small trees. Boulders are scattered around the perimeter of the pond.

Downstream from the dam, the channels contain trash, large stones, and fallen branches and other debris. Between the two channels is a thorough overgrowth of tangled vines and bushes interspersed by full-grown trees. The toe of the dam is swampy and vegetative cover characteristic of swamps and marshlands is present.

The channels leading from the dam lie in a depression (lowlying area). The banks of this area are steep and contain a thick growth of trees and bushes.

e. Test Flood Analysis. The recommended test flood for a "small" size and "high" hazard potential dam is between 1/2 PMF and PMF (Probable Maximum Flood), based on Corps of Engineers guidelines. The PMF was determined using Corps of Engineers guidelines for "Estimating Maximum Probable Discharge in Phase I Dam Safety Investigations". It was determined that the terrain of the watershed was primarily low-lying flat land. An inflow rate of 750 cfs per square mile was selected for a total watershed area of eight (8) square miles. The resulting PMF inflow is 6,000 cfs. For the purposes of this study, 1/2

PMF (3,000 cfs) was used at the test flood inflow.

Downstream (tail water) floodway profiles are influenced by the restricted flow area at a railroad embankment culvert located 3,200 ft. downstream from the dam. At flows below 3,000 cfs, water surface elevations upstream of the railroad embankment are governed by head losses through the culvert beneath this embankment. However, above 3,000 cfs the flow begins overtopping the embankment. Because the embankment is very long (length exceeds 3,000 ft.) its effect as a weir results in low differential head losses above 3,000 cfs. This and the relatively flat land cross-sections leading to the dam cause the hydraulic profile to yield characteristically small differences between flows in excess of 3,000 cfs.

Calculations of surcharge-storage routing were performed for Ellis Pond using related stage-discharge and area-volume curves. These curves and the calculations appear in Appendix D. The test flood outflow of 2,700 cfs results in a water surface elevation in Ellis Pond 1.3 ft. above the top of dam. The combined capacity of the two spillways is about 625 cfs or 23 percent of the test flood outflow with the existing stoplogs in place and 760 cfs or 28 percent of the test flood outflow with the stoplogs removed.

f. Dam Failure Analysis. The peak failure outflow is based on the Corps of Engineers Guidelines for Estimating Dam Failure Hydrographs assuming that the breach width is 40 percent of the length at the mid-height of the dam and that the pond level is at the top of the dam prior to failure. The outflow due to dam failure is estimated to be 11,655 cfs. The spillway discharge just before failure would be approximately 625 cfs if stoplogs were in place. Therefore, the total outflow at the time of failure is estimated to be 12,280 cfs. Dam failure and downstream channel calculations appear in Appendix D.

The profile of water surface elevation based on a spillway discharge of 625 cfs would in most reaches be below flood stage. Because of this prior condition, the failure could occur with people in the flood hazard area unprepared for dealing with the sudden wave of flood water. There is some storage capacity in the

downstream channel, but it is not enough to appreciably reduce the flood hazard potential. Within the hazard area shown on page D-1 are four areas worthy of specific mention: (1) the Walpole Street bridge, (2) the shopping center, (3) apartments east of Hawes Brook, and (4) the industrial and warehousing area.

Failure flood flow at Walpole Street, the downstream end of Reach 1, would be approximately 11,400 cfs. The bridge at Walpole Street would be inundated by five feet of water. The sudden onrush could result in casualties of motor vehicle drivers and passengers as well as pedestrians. The highway is well-travelled and the chances of vehicular or pedestrian traffic being on the bridge during a failure flood are high.

Reach 2 extends to a weir in Hawes Brook, where the failure flood flow would be approximately 10,550 cfs. The shopping center and its parking area are located on the west bank of Hawes Brook between Walpole Street and the weir on the brook profile. It would be expected that this area would be under as much as four feet of water, thus posing a danger for shoppers and employees at the shopping center. The apartments opposite Hawes Brook from the shopping center are also expected to be under four feet of water, a danger especially to those entering or leaving the buildings.

Reach 3 extends to the Aneline Building in the midst of the industrial and warehousing area. The failure flood flow at the downstream end of Reach 3 is estimated to be 9,300 cfs. Despite the distance from the dam to this area and the resultant storage the steep slope of the channel leading into a relatively flat slope results in a flood elevation of eight feet at the industrial/warehouse area. Therefore, this too is an area of high potential hazard.

Reach 4 runs through the industrial and warehousing area to the railroad embankment. Flow is reduced to approximately 8,100 cfs and, at the embankment, the water surface elevation is approximately two feet above the brook banks.

It can be concluded that, in the event of a dam

failure, a potential for loss of lives and excessive property damages exists at this dam site and the hazard potential classification can be considered high, in accordance with Corps of Engineers guidelines.

SECTION 6 - STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations. Indications of active erosion of the upstream slope and sloughing of the earth embankment on the downstream side were observed. The downstream wall has toppled in many areas. Evidence of seepage through the embankment is apparent. Roots of the decaying tree stumps on the embankment will also decay eventually, forming conduits for piping to develop. For these reasons, the embankment can only be considered marginally stable in its present poor condition.

The spillway weirs and aprons were obscured by flowing water. However, no evidence of settlement, lateral movement or other signs of structural instability was noted, except for the large vertical crack on the downstream wall left of the right (west) spillway which indicates past instability. Although the walls of the spillways appeared to be stable at the time of the site visit, continued deterioration of these walls could effect their structural stability.

b. Design and Construction Data. The results of seven test borings performed at the dam in 1972 are presented by Fay, Spofford & Thorndike, Inc. in their 1973 report. These borings provided sufficient data for them to conclude that "...the embankment was constructed with pervious materials without an impervious core" and that "...it is quite likely that there was no excavation to bedrock prior to placement of the embankment." A topographic plan of the dam is also included in the Fay, Spofford & Thorndike, Inc. report.

It can be concluded that the pervious embankment materials would be susceptible to piping, developed from seepage. Furthermore, the embankment would have little resistance to failure if it were overtopped during flooding. There is apparently no foundation cutoff to bedrock to prevent seepage under the dam. These reasons and also the surveyed steep, irregular configuration of the downstream side are additional

evidence that the embankment is marginally stable at best.

There are no known design and construction data on the spillways, thus precluding a theoretical analysis of their structural stability.

c. Operating Records. No operating records are known to exist for the embankment or the spillways.

d. Post-Construction Changes. Without design or "as built" drawings, it is not known what specific post-construction changes have taken place. None were noted in the available prior inspection reports. The various types of structural elements observed during the site visit would indicate that some alterations were performed over its estimated 170 years of existence. Certainly the concrete portion of the right spillway was not part of the original dam. Also, the 1973 report by Fay, Spofford & Thorndike, Inc. indicates that a gate house over the left spillway had been removed. Other modifications are likely to have been made.

e. Seismic Stability. Ellis Pond Dam is located just within a Seismic Zone 3. In accordance with Recommended Phase I Guidelines, suitable analyses made by equivalent static load methods should be on record for this dam. No such analyses have been made. Since the static structural stability of the dam in its present condition is considered to be marginal, it is unlikely that the dam would prove to be stable under seismic loading conditions.

SECTION 7 - ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition. The visual examination of Ellis Pond Dam revealed that the structure was in poor condition. There were no signs of impending structural failure, but in consideration of the many serious deficiencies noted and the grossly inadequate spillway capacity, the stoplogs in the spillways should be removed immediately.

Based on the results of computations included in Appendix D and described in Section 5, the spillways are not capable of passing the test flood, which for this structure is the 1/2 PMF. The test flood outflow of 2,700 cfs (inflow 3,000 cfs or 375 csm) would overtop the dam by about 1.3 ft. With the water level at the top of dam, the combined spillway capacity is about 625 cfs with the existing stoplogs in place and 760 cfs with the stoplogs removed or 23 and 28 percent of the test flood outflow, respectively.

b. Adequacy of Information. This evaluation of the dam is based primarily on visual examination, preliminary hydraulic and hydrologic computations, consideration of past performance and application of engineering judgement. Generally the information available or obtained was adequate for the purposes of a Phase I assessment. However, it is recommended that additional information regarding the condition of the spillways be obtained as outlined in Section 7.2.

c. Urgency. The recommendations for additional investigation and remedial measures outlined in Section 7.2 and 7.3, respectively, should be undertaken by the Owner and completed within one year after receipt of this report. Meanwhile, the stoplogs should be removed from the spillways immediately and kept removed as a precaution until the following recommended engineering studies and remedial measures or alternatives have been implemented.

d. Need for Additional Investigation. Additional

investigations should be performed by the Owner as outlined in Section 7.2.

7.2 Recommendations

It is recommended that the Town of Norwood, owner of the dam, engage a registered professional engineer experienced in the design of earth dams to undertake the following investigations:

1. Observe and evaluate the condition of the spillways during no or low flow conditions.

2. Assess the structural stability of the dam under static loads and the potential for a failure of the dam during a seismic event. Recommend what repairs and modifications to the earth embankment and spillways are needed to make the structure adequately stable.

3. Investigate methods to increase the spillway discharge capacity of the dam.

4. Since there is currently no low-level outlet at the dam site with which to lower the pond level below the spillway crest level, determine the size and location of an outlet which is required to lower the pond in cases of emergencies.

The Owner should then implement corrective measures on the basis of these engineering studies.

7.3 Remedial Measures

The dam is generally in poor condition, and it is considered important that the following items be accomplished:

a. Operation and Maintenance Procedures. The following should be undertaken by the Owner, in addition to the engineering studies outlined in Section 7.2, to correct the deficiencies noted during the visual examination:

1. Take whatever preventive measures are necessary to prevent the unauthorized installation of stoplogs at the spillways.

2. Clear the upstream and downstream slopes of the earth embankment of trees, brush and debris. After clearing, examine the embankment for evidence of animal burrowing activity and seepage. Remove tree stumps and major roots and place additional fill to increase the existing embankment cross-section as determined by the results of the engineering studies recommended in Section 7.2.2. Grass cover should then be established on the embankment and mowed several times each year.

3. Clear trees and brush, removing stumps and major roots, for at least twenty feet beyond the downstream toe of the dam, in order to examine the area for seepage and allow access for heavy equipment in the event of an emergency.

4. Replace missing stone riprap protection on the upstream slope after clearing vegetation and repairing the locally eroded areas.

5. Remove vegetation from all masonry joints and fill open masonry joints with mortar.

6. Clear all brush and debris from the spillways.

7. Fill the stepped portion of the left spillway channel with concrete in order to prevent debris from being trapped in the spillway.

8. Prepare an operations and maintenance manual for the dam. The manual should include provisions for annual technical inspection of the dam and for surveillance of the dam during periods of heavy precipitation and high reservoir water levels. The procedures should delineate the routine operational procedures and maintenance work to be done on the dam to ensure satisfactory operation and to minimize deterioration of the facility.

9. Develop a written emergency preparedness plan and warning system to be used in the event of impending failure of the dam or other emergency conditions. The plan should be developed in cooperation with local officials, downstream inhabitants and downstream businesses.

7.4 Alternatives

In consideration of the major deficiencies and inadequacies of the existing dam which have been extensively documented since 1966, the Owner should seriously consider the alternative of constructing a properly designed new dam at the site as proposed in the 1972 and 1973 engineering reports.

APPENDIX A - INSPECTION CHECK LIST

VISUAL INSPECTION PARTY ORGANIZATION

NATIONAL DAM INSPECTION PROGRAM

Dam: Ellis Pond

Date: 14 May 1979

Time: 0815-1130

Weather: Overcast, light rain, temperature high 60's

Water Surface Elevation Upstream: 112.7 NGVD, as measured at right (west) spillway

Stream Flow: Approx. 15 cfs

Inspection Party:

Harl P. Aldrich, Jr. Richard A. Brown Haley & Aldrich, Inc.	- Soils/Geology
A. Ulvi Gulbey	- Hydraulic/Hydrologic
Robert P. Howard	- Structural/Mechanical
Robert S. Sheldon Camp, Dresser & McKee, Inc.	

Present During Inspection:

Owner's representatives did not find inspection party at dam site

VISUAL INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: Ellis Pond DATE: 14 May 79

AREA EVALUATED	CONDITION
DAM EMBANKMENT	
Crest Elevation	Approx. El. 116.5 to 117.2 (except immediately adjacent to spillways where embankment is about El. 116.2 to 116.5)
Current Pool Elevation	El. 112.7 (NGVD)
Maximum Impoundment to Date	Unknown, but dam has reportedly been overtopped in the past
Surface Cracks	None observed at crest
Pavement Conditions	No pavement
Movement or Settlement of Crest	None observed
Lateral Movement	Stone wall located at downstream toe has collapsed along most of the length of the dam
Vertical Movement	Generally good; crest elevation varies approximately 1 ft. from maximum to minimum
Horizontal Movement	Width of crest varies considerably, resulting in an irregular top of slope, upstream and downstream
Condition at Abutment and at Concrete Structures	Satisfactory
Indications of Movement of Structural Items on Slopes	There are no structural items
Trespassing on Slopes	Unrestricted, but inhibited by difficult access and growth of brush
Animal Borrows in Embankment	None observed
Vegetation on Embankment	Brush recently cut on top of embankment; brush and weeds on upstream and downstream slopes. Several decaying tree stumps at top of downstream slope
Sloughing or Erosion of Slopes or Abutments	Active erosion on upstream slope immediately right of left spillway and left of right spillway, primarily foot traffic. Sloughing has occurred due to past collapses of downstream stone wall

FILE NO. 4160

HALEY & ALDRICH, INC.
CAMBRIDGE, MASSACHUSETTS

VISUAL INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: Ellis Pond DATE: 14 May 79

AREA EVALUATED	CONDITION
Rock Slope Protection - Riprap Features	Generally protected by boulders 1/4 to 1/2 cu. yd. in size on upstream slope; irregular configuration
Unusual Movement or Cracking at or Near Toes	None observed, but difficult to examine
Unusual Embankment or Downstream Seepage	Area immediately below downstream toe generally wet and swampy; surface water ponded; no springs noted but nearly impossible to examine closely
Piping or Boils	None observed (see above)
Foundation Drainage Features	None known to exist
Toe Drains	None known to exist
Instrumentation Systems	None
OUTLET WORKS - RIGHT SPILLWAY WEIR AND DISCHARGE CHANNEL	
a. Approach Channel	Not applicable
b. Weir and Training Walls	
General Condition of Concrete Walls	Concrete walls are in good condition
Rusting or Staining	Some minor staining
Spalling, Voids or Erosion	Some minor surface erosion
Any Visible Reinforcing	None observed
Any Seepage or Efflo-resence	None observed
Drain Holes	None observed
General Condition of Stone Masonry Walls	Stone masonry above spillway floor in good condition. The remaining portions of stone masonry walls in poor condition
Vegetation	Vine growth developing over walls

FILE NO. 4160

HALEY & ALDRICH, INC.
CAMBRIDGE, MASSACHUSETTS

VISUAL INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: Ellis Pond DATE: 14 May 79

AREA EVALUATED	CONDITION
Cracks	A crack in the wall above a 12-in. pipe in right stone masonry wall. A large vertical crack in the stony masonry wall on the left side of spillway at the downstream end
Spalling and Erosion	Minor joint erosion at the spillway floor slab. Extensive spalling, erosion and loss of grout of the joint of the stone masonry walls downstream of drop
Stoplogs	Two wooden stoplogs in place and submerged
Downstream Face of Weir (drop)	Obscured from view by a heavy flow of water
c. Discharge Channel	
General Condition	Fair
Loose Rock Overhanging Channel	None observed
Trees Overhanging Channel	Extensive brush and trees overhanging channel
Floor of Channel	Remains of stone masonry walls along channel and stone debris in the channel
OUTLET WORKS - LEFT SPILLWAY WEIR AND DISCHARGE CHANNELS	
a. Approach Channel	Not applicable
b. Weir and Training Walls	
General Condition of Masonry Walls	Grouted stone masonry walls in fair to poor condition
Rusting or Staining	Staining and rust observed
Spalling	Extensive loss of grout at the bottom portion of the walls for the full length of spillway

VISUAL INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: Ellis Pond DATE: 14 May 79

AREA EVALUATED	CONDITION
Any Seepage	Seepage from both walls just downstream of stoplogs. Water flowing from downstream end of walls indicating water flowing through joints and under the walls
Drain Holes	None observed
Stoplogs	Stoplog guides and support channel are in good condition. Four feet of stoplogs in place with some leaking observed. Heavy flow of water over stoplogs
Floor of Spillway	Floor of spillway is a stepped cascade. First step appears to be concrete and remaining steps are pools formed by wooden logs. Heavy debris in stepped pools. Heavy flow in spillway channel
c. Discharge Channel	
General Condition	Fair
Loose Rock Overhanging Channel	None observed
Trees Overhanging Channel	Extensive brush and trees overhanging channel
Floor of Channel	Remains of stone masonry walls along channel and stone debris in channel

APPENDIX B - ENGINEERING DATA

LIST OF AVAILABLE DATA
ELLIS POND DAM

Document	Content	Location
County inspection report, Ellis Pond Dam	Summary of inspections on 10 April 1968 and 27 May 1968	Mass. Dept. of Environmental Quality Engineering, Division of Waterways, 100 Nashua Street, Boston, MA 02114 and page B-2
State inspection reports, Dam No. 6-11-220-1	Letter report on 1 June 1971 inspection with Town Engineer and report on 16 September 1974 inspection, including cover letter and description of dam	Mass. Dept. of Environmental Quality Engineering and pages B-5 through B-14
Ellis Pond Spillway Investigation, Chas. T. Main, Inc., Boston, MA, April 1966	Letter report on investigation of the feasibility of reconstructing the south spillway	Norwood Town Engineer, Municipal Building, Norwood, MA 02062
Engineering evaluation report, Ellis Pond Dam, Whitman and Howard, Inc., Wellesley, MA, June 1971		Norwood Town Engineer
Reconnaissance report on Ellis Pond, Soils Conservation Service, U.S. Department of Agriculture, February 1972	Hydrologic and hydraulic study prepared for the Norwood Board of Selectmen through the Norfolk Conservation District	Norwood Town Engineer and page B-15

LIST OF AVAILABLE DATA
ELLIS POND DAM (Continued)

Document	Contents	Location
Planning Study, The Ellis Pond - Guild Pond Recreation Area, Fay, Spofford & Thorndike, Inc., Engineers, Boston, MA, April 1973	Bound report on investigation and study for improvements to the Ellis Pond Dam and for the development of the Ellis Pond and Guild Pond areas as recreational facilities. Includes site plan, plan of surveyed existing dam and proposed new dam, and logs of test borings at dam site. Supersedes prior engineering evaluation reports	Norwood Town Engineer and selected sections on pages B-21 through B-39

COUNTY OF NORFOLK

CHARLES C. CAIN
COUNTY ENGINEER

TEL. 326-1600

ENGINEERING DEPARTMENT

DEDHAM, MASS.

July 15, 1968

Norfolk County Commissioners
Superior Court House
Dedham, Massachusetts 02026

Gentlemen:

I herewith submit a report on the dam located at Ellis Pond in Norwood owned by Robert A. Fairbairn, Orville W. Forte' Jr. and Donald Forte', Trustees of Davis Avenue Trust, which has been visited and examined in accordance with G.L. Chapter 253 as amended.

This is an earth dam located about 200 feet northwesterly of ~~Washington~~ Walpole Street, Norwood, near the intersection of Endicott Street.

The dam was visited by a man from the Norfolk County Engineering Department on April 10, 1968, following the high waters which occurred in March and was visited and examined by men from the Engineering Department on May 27, 1968.

It is my opinion that the condition of the dam is such that it cannot be considered to be safe and in good condition. Its overall condition is poor and in some areas dangerous conditions exist.

Large trees and brush growing over the entire dam should be removed and the dam repaired where the stumps are removed.

A large section of the high retaining wall on the downstream face of the westerly end of the dam has collapsed

and the remaining section of this high wall is very near the point of collapsing. This has caused considerable erosion of the dam in this area. These are dangerous conditions and should be repaired.

At the spillway at the westerly end of the dam the rip rap above the water line has eroded. Some suitable means of preventing damage at both sides of this spillway on the pond side should be constructed. Also, at this spillway, portions of the stone retaining walls are in need of repair.

Several portions of the stone retaining walls on the downstream face of the center portion of the dam have fallen and should be repaired.

At the spillway at the easterly end of the dam there is some erosion at the stone retainning walls which should be repaired.

Since it is apparent that the capacity of the spillways is not sufficient to take the flow during extreme high waters the capacity of the spillways should be increased to prevent water from flowing over the earth dam.

Some mention should be made of the fact that there is an area of mud just below the toe of the slope on the downstream side at approximately the middle of the dam. Also, between this mud and the brook near ~~Washington~~ Maple Street there is water percolating out of a small area where some stones have been placed. Some fine material has been washed out with this water. The relative importance of these conditions to the dam and their effects on the dam may be questionable.

Respectfully submitted,

Charles C. Cain
County Engineer

DAM# 6-11-220-1

Mason Tenaglia

Fred. C. Schwalm, Acting Deputy Chief Engr. June 2, 71

NORWOOD-Inspection of Ellis Pond Dam

Met with Town Engineer R. Hamilton on June 1st and we inspected the existing earth dam and spillways at Ellis Pond.

It is evident that at some time in the past, the dam has been over-topped. The spillways are inadequate and badly in need of repair. Lush growth of trees and brush on the downstream side of the dam leads me to believe that the impervious core is either non-existant or is in a very poor condition and only extensive test borings and trenches could produce this information.

A draw down pipe and gate should also be included with the proposed repair and re-conditioning of this dam.

Costs for new spillways and a draw down pipe could be from $25,000.00 to $30,000.00, and costs for repairs to the earth dam itself would depend on what the borings and tests would determine needed to be done.

I also discussed procedures with Engineer Hamilton whereby after a study in-depth, a registered professional engineer would design and prepare plans for the repairs and submit these plans with a completed application for the authority to make these repairs or alterations.

There is a free flow of water through the open spillway, therefore, the dam and pond presents no problems at the present level.

Respectfully submitted,

MT/emm

MASON TENAGLIA
Assistant Civil Engineer

cc: Board of Selectmen-Norwood
Town Engineer

October 2, 1974

Board of Selectmen
Town Hall
Norwood, Massachusetts

RE: Inspection-Dam #6-11-220-1
Norwood
Ellis Pond Dam

Gentlemen:

On September 16, 1974, an engineer from the Massachusetts Department of Public Works made a visual inspection of the above dam, owned by the Town of Norwood.

The inspection was made in accordance with Chapter 253 of the Massachusetts General Laws, as amended by Chapter 595 of the Acts of 1970 (Dams-Safety Act).

The results of the inspection indicate that repairs are needed. A complete inspection could not be made due to the growth of brush along the downstream toe of the slope. Mrs. Cottrell, Chairperson of the Norwood Conservation Commission has advised us of the unauthorized installation of flashboards in the spillway. Although this appears to be of no hazard at this time it is recommended that the flashboards be removed as a safety precaution in the event of possible high water conditions. The following conditions were noted that require attention:

1. The stone retaining wall at the westerly end of the dam has collapsed. This condition has existed for a number of years and was noted in the Norfolk County inspection of 1968.

2. There is erosion at both spillways and slope protection is necessary.

3. The county inspection of 1968 has indicated that the spillway capacity is not sufficient to accommodate flood flows. An investigation followed by the enlarging of the spillway capacity is necessary.

4. Seepage has been indicated below the toe of the slope near the center of the embankment. Investigation and corrective action is needed.

It appears that an engineering study was conducted in 1966 to improve the spillway capacity. This should be pursued. It is recommended that you obtain the services of a Registered Professional Civil Engineer experienced in the design, maintenance and construction of dams.

It appears that the Conservation Commission, with limited funding, is attempting to maintain the dam. Funding or technical assistance may be available through a variety of programs, a listing is enclosed. If the project qualifies as a flood control structure, the United States Army, Corps of Engineers may provide assistance. It is recommended that you seek their advice. The Division of Waterways may also provide funding assistance through the provisions of Chapter 91 of the Massachusetts General Laws. Enclosed please find an outline of the necessary steps to assure our participation.

If we may be of further assistance please do not hesitate to contact us. Your questions may be directed to Mr. Leo Andromico of this office, telephone 727-4793.

Very truly yours,

MALCOLM R. GRAF, P.E.
Associate Commissioner

LRA:jmp
Enclosures
cc: Mrs. Cottrell, Chairperson
J. T. Cronin
A. Lounsbury

INSPECTION REPORT - DAMS AND RESERVOIRS

Location: City/Town NORWOOD. Dam No. 6-11-220-1

Name of Dam ELLIS POND INSPECTED BY: A.H. LOUUSBURY

Date of Inspection SEPT 16, 1974.

2. Owner/s: Pers. Assessors _____. Prev Inspection _____.

Reg. of Deeds _____. Pers. Contract ✓.

1. TOWN OF NORWOOD - CONSERVATION COMMISSION
Name St. & No. City/Town State Tel No.

2. MRS. COTTRELL CHR. NORWOOD MASS. 769-0955
Name St. & No. City/Town State Tel No.

3. _____
Name St. & No. City/Town State Tel No.

4. Caretaker (if any) e.g. superintendent, plant manager, appointed by absentee owner, appointed by multi owners.

_____
Name St. & No. City/Town State Tel. No.

5. No. of pictures taken County Records only

6. Degree of Hazard: (If dam should fail completely)*

1. Minor _____. 2. Moderate _____.

3. Severe ✓. 4. Disastrous _____.

*This rating may change as land use changes (Future development)

7. Outlet Control: Automatic _____. Manual ✓.

Operative ✓ yes; _____ No.

Comments: FLASHBOARDS, 4 BAY, 3.5 ON CENTER

8. Upstream Face of Dam: Condition:

1. Good _____. 2. Minor Repairs ✓

3. Major Repairs ___. 4. Urgent Repairs _____

Comments: SOME EROSION EVIDENT

DAI NO. 6-11-220-1

8. Downstream Face of Dam: Condition: 1. Good ____. 2. Minor Repairs ____.
3. Major Repairs ✓. 4. Urgent Repairs ____.
Comments: FALLEN STONES - EROSION

9. Emergency Spillway: Condition: 1. Good ✓. 2. Minor Repairs ____.
3. Major Repairs ____. 4. Urgent Repairs ____.
Comments: FLASHBOARDS 10' LONG. CONTINUOUS

10. Water level @ time of inspection: 4.2 ft. above ____. below ✓.
top of dam ✓. principal spillway ____.
other ____.

11. Summary of Deficiencies noted:
Growth (trees and brush) on embankment MOST REMOVED - STUMPS REMAIN
Animal burrows and washouts SEVERAL.
Damage to slopes or top of dam YES - SLOPES.
Cracked or Damaged Masonry NONE.
Evidence of Seepage NONE VISIBLE - SHOULD REEXAMINE WHEN CLEARED.
Evidence of Piping " " " " " ".
Erosion WESTERLY END & CENTER.
Leaks SIDEWALL AT EASTERLY SLUICE.
Trash and/or debris impeding flow DOWNSTREAM CHANNEL - EASTERLY SLUICE.
Clogged or blocked spillway NO.
Other ____.

DAM NO. 6-11-220-1

12. Remarks & Recommendations: (Fully Explain)

AVAILABLE RECORDS INDICATE THAT THE FLOOD LEVAL OF AUG 18, 19, 1955 CAME TO WITHIN 1' OF THE TOP OF THE EARTHEN EMBANKMENT, SUBSEQUENTLY OVER TOPPING AT THE WESTERLY END WHERE A STONE RETAINING WALL COLLAPSED (IN A COLLAPSED STATE THIS DATE)

NORFOLK COUNTY INSPECTION IN 1968 DETARMINED THAT

1) THE DAM COULD NOT BE CONSIDERED SAFE AND IN GOOD CONDITION
2) LARGE TREES AND BRUSH SHOULD BE REMOVED
3) THE EROSION AT THE WESTERLY END OF THE DAM JEOPARDIZED A REMAINING SECTION OF A HIGH WALL
4) EROSION AT BOTH SPILLWAYS NEEDED CORRECTION
5) THE CAPACITIES OF THE SPILLWAYS IS NOT SUFFICIENT TO TAKE THE FLOW DURING EXTREME HIGH WATERS.
6) SEEPAGE APPEARED BELOW THE TOE OF THE DAM, NEAR THE MIDDLE OF THE EMBANKMENT

THE LARGE TREES HAVE BEEN REMOVED, BUT STUMPS REMAIN

THERE IS STILL A GENERAL APPEARANCE OF FALLEN STONES

DENSE UNDERBRUSH FROM THE TOE OF THE SLOPE TO THE ROAD PREVENTS A GOOD VISUAL INSPECTION OF THE DOWNSTREAM AREA

ON AUGUST 11, 1974 THIS OFFICE WAS CONTACTED BY MRS. COTTRELL, CHR. NORWOOD CONSERVATION COMMISSION RELATIVE TO THIS DAM WHICH THE TOWN NOW OWNS. SHE ADVISED THAT PERSONS UNKNOWN HAD PLACED BOARDS IN THE SPILLWAY, AND WAS CONCERNED IF THESE BOARDS WOULD CAUSE DAMAGE. THE COMISSION HAS LIMITED FUNDS BUT IS ATTEMPTING TO IMPROVE THE STRUCTURE. TREES HAVE BEEN REMOVED.

A FIELD INVESTIGATION ON SEP'T. 16, 1974 SHOWED THAT BOARDS HAD BEEN PLACED IN THE WESTERLY SPILLWAY (1.4 FT. ABOVE BOTTOM OF SPILLWAY, 4.4 FT. FROM TOP OF DAM) CONDITIONS AT THE TIME OF INSPECTION DID NOT INDICATE ANY HAZARD. IT IS FELT THAT FURTHER PLACING OF BOARDS COULD CAUSE HARM

(CONTINUES ON REVERSE SIDE)

13. Overall Condition:

1. Safe _____.
2. Minor repairs needed _____.
3. *Conditionally safe-major repairs needed ✓.
4. Unsafe _____.
5. Reservoir impoundment no longer exists(explain)
   Recommend removal from inspection list. _____.

* PROVIDED THAT SUFFICIENT FREEBOARD IS MAINTAINED

CONT

THE DAM IS HIDDEN FROM VIEW FROM THE STREET AND IT IS FELT THAT REMOVAL OF THE DENSE BRUSH WILL EXPOSE THE AREA OF THE DAM TO VISUAL OBSERVATION FROM THE STREET, MINIMIZING THE UNAUTHORIZED MANIPULATION OF THE FLASH BOARDS.

THE REMOVAL OF THE BRUSH WILL ALSO ALLOW US TO MAKE THE NECESSARY EXPLORATION OF THE DOWNSTREAM AREA.

THE COMMISSION SHOULD CHECK THE DAM PERIODICALLY AND REMOVE ANY FUTURE BOARDS ADDED TO THOSE IN PLACE.

MRS. CARROLL WAS ADVISED VERBALLY ON SEPT. 5, 1974 TO TAKE THOSE STEPS TO DETER UNAUTHORIZED BOARD PLACING.

APPARENTLY AN ENGINEERING STUDY WAS MADE IN 1966 TO IMPROVE SPILLWAY CAPACITY. THIS COULD BE PURSUED.

GENERALLY TITLE HAS BEEN DONE TO MAKE THE NECESSARY REPAIRS OUTLINED

DESCRIPTION OF DAM

DISTRICT 6

Submitted by A. H. LOUNSBURY

Date SEPT. 17 1974.

Dam No. 6-11-220-1

City/Town NORWOOD

Name of Dam ELLIS POND

1. Location: TOpo Sheet No. 32A

Provide 8½" x 11" clear copy of topo map with location of Dam clearly indicated. ✓

2. Year built: UNKNOWN, (PRIOR TO 1945) Year(s) of subsequent repairs UNK

3. Purpose of Dam: Water Supply ____. Recreational ✓
Irrigation ____. Other ____

4. Drainage Area TOTAL 6.5 sq.mi. TOTAL 4.63 acres.
INDIVIDUAL DAM 2.2 Sq. Mi. 1425 Acres

5. Normal Ponding Area 15 Acres; Ave. Depth 8'
Impoundment 38 Million gals; 118 acre ft.

6. No. and type of dwellings located adjacent to pond or reservoir
i.e. summer homes etc. 10± Permanent

7. Dimensions of Dam: Length 280'. Max. Height 20'
Slopes: Upstream Face Assumed 2:1
Downstream Face 1:1
Width across top 15 FT.

8. Classification of Dam by Material:
Earth ✓. Conc. Masonry ____. Stone Masonry ____
Timber ____. Rockfill ____. Other ____

9.
A. Description of present land usage downstream of dam: ____% rural; 100 % urban.

B. Is there a storage area or flood plain downstream of dam which could accommodate the impoundment in the event of a complete dam failure YES ____. NO. ✓.

DAM NO. C-11-220-1

Risk to life and property in event of complete failure.

No. of people Estimate 100

No. of homes APARTMENT HOUSE COMPLEX

No. of Businesses SHOPPING CENTER

No. of Industries 4-6 Type Lt. to Med

No. of Utilities NONE Type

Railroads ~~NONE~~ ONE

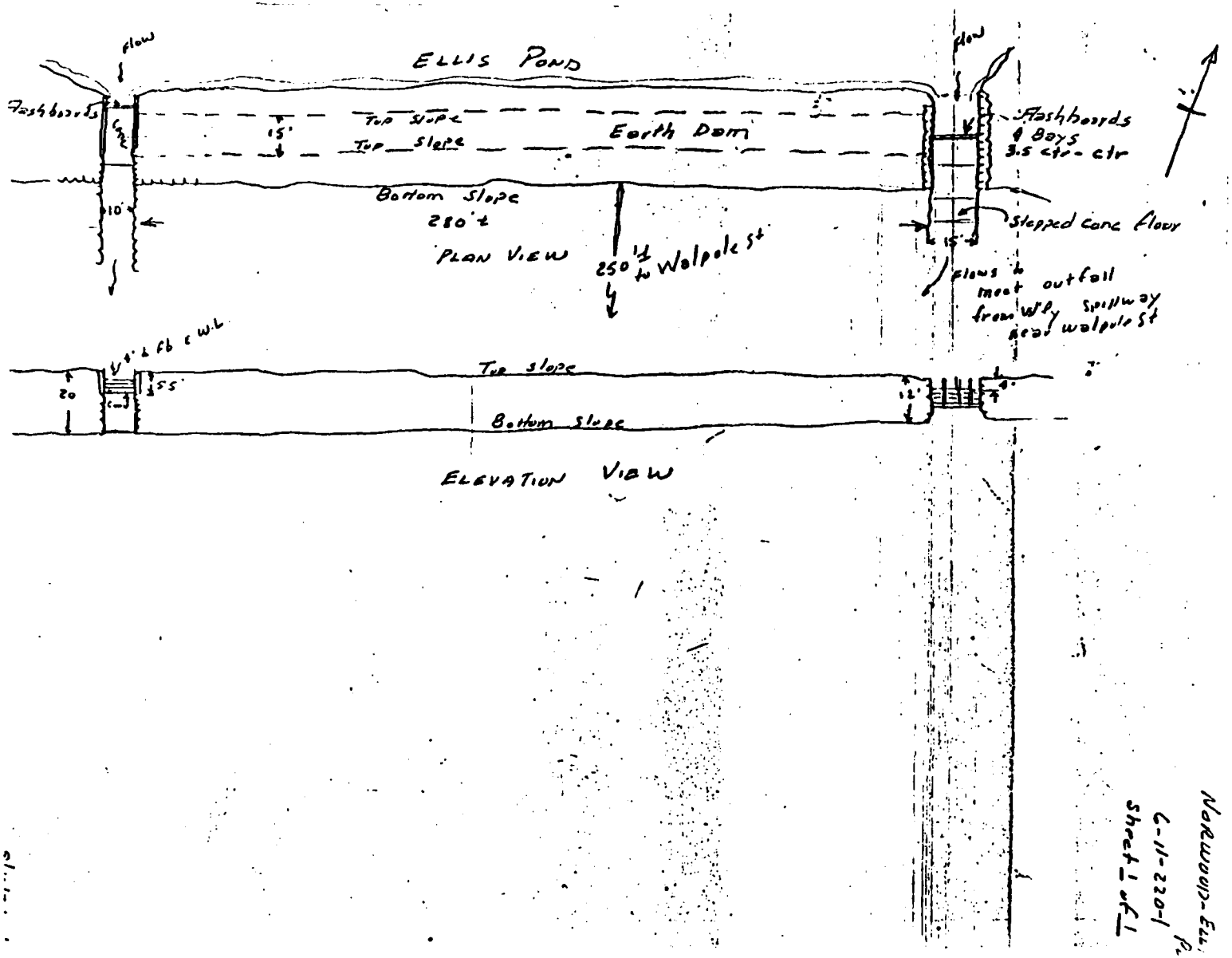
Other Dams C-11-220-3

Other WALPOLE ST.

Attach Sketch of dam to this form showing section and plan on 8½" x 11" sheet ✓

WALPOLE ST. IS ABOUT 250' DOWNSTREAM OF DAM. THE HIGHWAY (RTE 1-A) IS 6' TO 8' ABOVE THE ADJOINING LAND AT TWO RCP CULVERTS CARRIES THE STREAM UNDER. IF THE DAM FAILED, THE HIGHWAY WOULD DETER THE FLOW, BUT DUE TO THE LIMITED STORAGE AREA INVOLVED, WOULD PROBABLY BE FLOODED.

THIS CULVERT IS CLASSIFIED AS A SUBSTANDARD BRIDGE AND IS CURRENTLY UNDER DESIGN STUDY BY SOMERVILLE ENGINEERING INC. FOR THE DEPARTMENT. (STATE HIGHWAY)



Norwood-Ell.
C-11-220-1
Sheet 1 of 1

RECONNAISSANCE REPORT

ELLIS POND

NORWOOD, MASSACHUSETTS

FEBRUARY 1972

Prepared by:

THE SOIL CONSERVATION SERVICE

U. S. DEPARTMENT OF AGRICULTURE

In Coorporation with:

THE NORFOLK CONSERVATION DISTRICT

RECONNAISSANCE REPORT

ELLIS POND

NORWOOD, MASSACHUSETTS

FEBRUARY 1972

A. INTRODUCTION

The Board of Selectmen, Norwood, Massachusetts, through the Norfolk Conservation District, requested that the USDA, Soil Conservation Service, examine the dam at Ellis Pond and suggest how it might be repaired or restored, and prepare a cost estimate for accomplishing this work.

This preliminary investigation is based on a field reconnaissance of the site by SCS personnel, a map study using the USGS Topographical Quadrangle for Norwood, Massachusetts, and hydrologic and hydraulic computations using SCS procedures and criteria. This report is based on preliminary investigations and the information presented is not to be considered final or complete. More detailed studies, field surveys, geologic investigations, and hydrologic evaluations will be required if the project is to be implemented.

B. DESCRIPTION of the SITE

Ellis Pond, when full, provided about 16½ acres of water area. In compliance with the County Commissioners' directive, the pond has been partially drained since the dam was considered unsafe. This draining has exposed much of the gently sloping shoreline and has reduced the value of the pond for recreational uses.

The dam at Ellis Pond is an old ice pond dam in poor condition. The overall height of dam is about 20 feet. A vertical wall of large stone supports the down stream face of this structure. At present, the rock facing has toppled over in many places and the earthen sections have sloughed off. There are large trees growing on the earth fill throughout its length and it appears that the tree roots have contributed to the leakage which is apparent along the downstream toe of dam. Many very large boulders are visible in the earth fill portions. There are two spillways associated with this structure. The spillway on the right abutment is a concrete weir-type structure with an opening of five (5) feet in width and five (5) feet in depth. The drop from the crest of the spillway to the brook bottom is approximately ten (10) feet. The spillway located at the left abutment is of stone rubble masonry approximately 12 feet wide and six (6) feet in depth. This structure is equipped with flashboards for regulating water depths in the pond. Rock ledge outcrop is visible just downstream of this spillway.

The area along the north bank of Ellis Pond has been developed as a residential area. A hand level reading indicates that the base of these buildings is about six (6) feet higher than the present crest of the spillway on the left abutment. This would limit a design high water elevation during storm runoff to about five (5) feet above the spillway crest.

C. ANALYSIS

Due to the limited capacity of the existing spillways and the deteriorated condition of the dam, it does not appear feasible

or technically sound to attempt to repair this structure. The recommendation is to remove the older works and replace the dam in its entirety or to build a new dam just upstream from the present one.

It is noted that this dam is classified as a high hazard structure due to its size, the large contributing drainage area, the volume of water stored, and the location of urban development downstream from Ellis Pond. The failure of a dam in this location would jeopardize life and property.

D. LAND USE CONSIDERATIONS

Ellis Pond is located within a highly developed residential and commercial area. It presently provides open space and a recreational area for nearby residents. Improvement of the site by cleaning up the facility, provision of a reasonably sized parking area and trail access to the pond, and deepening and increasing the area of water, would make Ellis Pond a more attractive facility for a greater number of people. Fishing, boating, ice skating and wildlife enhancement and observation are activities that may be encouraged by proper management of the site. Since Ellis Pond is one of the few remaining open spaces in Norwood and a deficiency of outdoor waterbased recreation facilities is apparent it is suggested that serious consideration be given to development of this site for these uses. According to our design standards, if a new dam was constructed at Ellis Pond, a spillway measuring approximately 180 feet long would be necessary in order to safely pass high intensity storm flows without flooding adjacent property.

The normal water level would be raised to the crest of the existing spillway on the right abutment or approximately three (3) feet higher than present water level. The estimated cost of this construction is $150,000. Any plans and designs would be subject to approval by the Massachusetts Department of Public Works.

A possible alternative to constructing a new dam is to retain existing water levels and to deepen and enlarge the present pool area by excavation. On 1970 aerial photographs, Ellis Pond measures about 16 acres. Deepening this area by five feet would require removal of 128,000 cubic yards of earth. Some of this might be used to fill in unflooded areas which would result in better access to the pond edges by the general public. The estimated cost of this work has not been calculated since present water depths and pond bottom soil conditions are not known.

Benefits associated with deepening the pond and removing accumulations of muck are likely to be: cooler summer water temperatures, a reduction in weed growth, better fishing, and perhaps a lessening of objectional pond water odors during the summer months. Prior to adopting this alternative, the town should have a comprehensive geologic investigation made to determine effects on water-holding capability.

E. OTHER CONSIDERATIONS

Two important but unknown factors that have and will have a significant effect on the eventual development and use of Ellis Pond is water quality and quantity. Our map inspection suggests that water from Willett Pond is probably quite high in quality but that flows from this watershed are probably low since it

serves as a water supply reservoir. Germany Brook, on the other hand, flows water of doubtful quality since it receives large quantities of runoff from urban and suburban areas. It is suggested that the water quality of all inflowing streams be monitored on a periodic basis and that a water quality improvement and maintenance program be prepared and implemented in order to insure continued use of this facility.

Signed _____

Richard L. Pratt
Engineering Specialist

_____

Robert N. Morehouse
District Conservationist

FAY, SPOFFORD & THORNDIKE, INC.
ENGINEERS

11 BEACON STREET • BOSTON, MASSACHUSETTS 02108
(617) 523-6300

April 10, 1973

Board of Selectmen
Municipal Building
Norwood, Massachusetts 02061

Gentlemen:

We are pleased to submit herewith a report on our investigation and study for improvements to the Ellis Pond Dam and for development of the Ellis Pond and Guild Pond areas as recreational facilities. The report was prepared in accordance with our agreement of September 13, 1972 with the Town of Norwood. It furnishes cost estimates together with planning for improving the dam and developing the recreational possibilities of the pond areas.

The project will require extensive earthwork and masonry work along with the general site improvements and refinements needed for recreational purposes. It is recommended that the work be staged. Stage One would be for the heavy construction which will include the reconstruction of the Ellis Pond Dam, the reconstruction of the Guild Pond Spillway, excavation of the two ponds and the cleaning up and regrading of the area below the Ellis Pond Dam. Stage Two would cover the finished site improvements including the installation of the supporting utilities and recreational facilities together with the required grading, seeding and planting needed to make this an attractive and successful recreational site.

Stage Two could be separated into Stages Two and Three with the former pertaining to the Ellis Pond improvements and the latter to those for Guild Pond. Stage Three would also include improvement of the area located between the two ponds.

Costs for land acquisition, reconstruction and development, including costs for engineering services required to prepare contract documents and required during construction, will be approximately $770,000.

FAY, SPOFFORD & THORNDIKE, INC.
ENGINEERS
BOSTON, MASS

We wish to acknowledge the excellent cooperation and assistance of the municipal officers of the Town of Norwood and the staff of the U.S. Soil Conservation Service.

Very truly yours,

FAY, SPOFFORD & THORNDIKE, INC.
By

Donald M. Thornquist
Associate

DMT:mg

Planning Study

The Ellis Pond-Guild Pond Recreation Area

TABLE OF CONTENTS

THE REPORT

A. DESCRIPTION AND HISTORY

Ellis Pond and Guild Pond, owned by the Davis Building Trust, are man-made reservoirs with water surfaces that one time covered areas of 16 acres and 3 acres, respectively. Age and deterioration have taken their toll. The earthfill dams are in need of repair, the pond bottoms have silted up and have become overgrown with vegetation and the surface areas have dwindled to less than half their original size.

The two ponds are separated by a very wet and overgrown area approximately 900 feet in length and 400 feet in width. Several channels criss-cross through the area carrying the water from the higher Guild Pond easterly to Ellis Pond. Both bodies of water are located entirely within a residential-commercial section of the Town of Norwood bordered by Walpole Street, Wilson Street, Bullard Street, Brook Street, Nichols Street and George F. Willett Parkway. Water sources are from Germany Brook to the North, emptying directly into Ellis Pond, and Willett Pond to the West, emptying into Guild Pond. The water from Ellis Pond is channelled to two stone arch culverts under Walpole Street which carry it to Hawes Brook and then on to the Neponset River. The Walpole Street culverts are ten feet by seven feet and five feet by four feet and have a combined capacity of around 850 cfs. The invert of the smaller culvert is about a foot higher than that of the larger and is partially blocked.

Except for references made to an old Town map, there are no records relating to the history of the ponds. The Town Engineer recalled that this map showed Ellis Pond along with an old mill to be in existence some 140 years ago. Today an old stone masonry weir with a ten foot drop from crest to toe remains as part of the westerly portion of the dam, giving evidence that the pond may at one time have been used to store the water needed to furnish energy to drive a water wheel. It is likely that the pond was also a source of supply for the manufacture of ice.

There are no records as to why Guild Pond was constructed. For some time it was maintained by a sportsman club and was stocked with trout for annual fishing derbies. This activity has since been abandoned and, except for ice skating in the winter and duck feeding in the summer, the area remains quite dormant.

Photographs 1 and 2 are pictures of Ellis Pond and Guild Pond, respectively.

The Ellis Pond dam is a 400 foot earthfill structure with approximately 100 feet of stone facing along its westerly end and with a stone-concrete masonry spillway at each extremity. Its average height is about 16 feet. The top is at elevation 116.5 and varies in width from 16 to 30 feet, the widest portion being at its midsection. From observation, it appears evident that at some time during the life of the dam, additional fill was placed along the front face of the midsection in an apparent attempt to seal off leaks

and to strengthen the structure. The water level in the pond is held at elevation 110.5 and depths behind the dam range between 5 and 7 feet. As mentioned, records indicate the dam to be at least 140 years old and that the west spillway may have been a part of an old mill.

The west spillway is a weir type structure with a five foot by five foot opening and a ten foot drop from crest to the toe. The crest is about three feet higher than that of the east spillway. At present, except for leakage, there is no flow through it.

Photograph 3 is an upstream view of the west spillway and the westerly portion of the Ellis Pond Dam. Photograph 4 is a downstream view of the west spillway.

The east spillway is 12 feet wide with a 6 foot freeboard and was originally equipped with manually operated flashboards to control the water level in the pond. The flashboards were operated from an enclosure bridging the spillway and have since been removed in order to maintain a safe level in the pond. Except for leakage, flows from Ellis Pond into Hawes Brook are through the east spillway. It was noted that considerable debris has accumulated within the spillway and in the channel area downstream.

Photograph 5 is an upstream view of the east spillway and the easterly portion of the Ellis Pond Dam. Photograph 6 is a downstream view of the east spillway.

In August, 1965, during hurricane "Diane" high water reached a level where it started to overtop the dam at the east spillway. The flashboards were in place and an attempt at that time to remove them was unsuccessful. Again during a storm in 1968, the high water reached the top of the dam. Following this occurrence, the owner removed the flashboards.

The dam is in poor condition. The stone facing and masonry has toppled over in many places and earth sections have sloughed off. Considerable leakage has been observed emanating from under the dam in the vicinity of the west spillway and the midsection. A very wet area of about 70 feet by 50 feet exists in front of the midsection, and about 75 feet from its toe there is a spring with a small stream flowing from it. There are many large trees, some with diameters up to 36 inches, growing on the earthfill throughout its length.

Essentially, the leakage can be attributed to excessive root growth and to structural deficiencies. Subsurface explorations confirm the latter.

Exploratory borings taken through and around the dam indicate a strata of rock three to ten feet below ground water level. They show that the embankment was constructed with pervious materials without an impervious core and they also show that it is quite likely that there was no excavation to bedrock prior to placement of the embankment.

The Guild Pond Dam is an earthfill structure a little over 200 feet in length and approximately six feet in height with a twelve foot stone-concrete

Ellis Pond Dam. An earthfill dam designed to cope with a 100 year storm is appropriate for this particular site. The dam would be constructed of pervious sand and gravel and with an impervious core to prevent leakage through the dam and possible severe damage or failure. At the westerly end of the dam would be a concrete spillway designed to serve as both the principal and emergency spillway. Excavation for the impervious core and for the spillway foundation would be the bedrock. This could be accomplished with little difficulty since exploratory borings indicate the top of rock to be only three to ten feet below ground water level.

So that existing streams could be effectively diverted and ground-water interference kept to a minimum, it is recommended that the concrete spillway be built first. The streams could then be rediverted through the spillway's drawdown conduit permitting the earthfill portion of the dam to be constructed with comparatively little ground water interference.

All trees, undergrowth, masonry and riprap should be removed from the existing earthfill and the salvageable masonry and riprap stored in close proximity for later use. The existing earthfill should be retained as the down-stream portion of the new dam and the new portion constructed immediately upstream.

Plate II is a plan view of the proposed dam with cross-sections through the spillway and the earthfill showing suggested details.

The concrete spillway would have a 100-foot weir with a six and a half-foot freeboard. The top of the weir to be at elevation 112.5 feet. For drawdown, a 36-inch conduit would be installed as an integral part of the spillway, the invert at the influent end to be at the level of the bottom of the pond behind the dam. A sluice gate, power or manually operated, would be installed at the effluent end of the drawdown pipe. The drawdown would provide a means to lower the water level below the crest of the weir or to empty the pond to permit periodic cleaning and dam inspection.

As previously stated and as shown in Plate II, it is proposed that the existing earthfill be cleaned, reshaped and retained as the downstream portion of the new dam. The top of the new dam would be fifty feet wide and set at elevation 119.0 feet. Material for the core must come from off the site since no impervious material appears to be available from the pond beds. For the pervious portion of the dam outside the core, materials from the pond bottom can be used. The upstream face of the dam would be riprapped using materials salvaged from the existing fill and recovered from other areas within tne project limits. The downstream face would be loamed and seeded to protect it from erosion. Little, if any, riprap material would have to come from off the site.

Area Below the Ellis Pond Dam. The area between the dam and Walpole Street would be cleaned up and regraded after completion of the new dam. Undergrowth, scrub trees and debris would be removed with selected

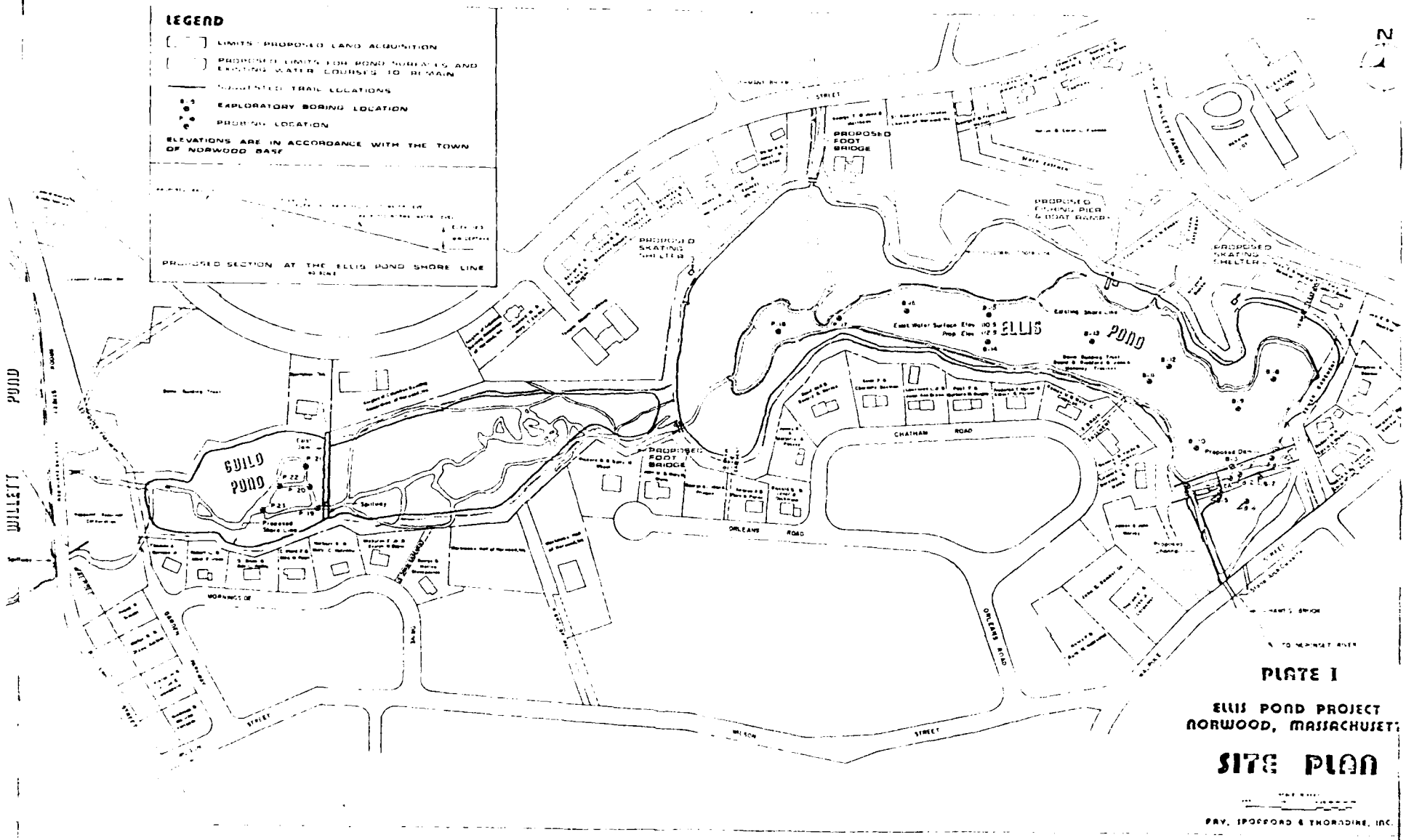


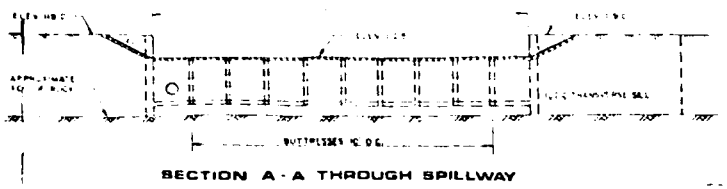
PLATE I

ELLIS POND PROJECT
NORWOOD, MASSACHUSETTS

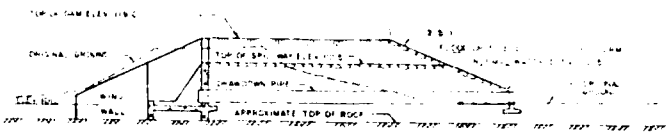
SITE PLAN

PAY, IPOSFORD & THORNDIKE, INC.

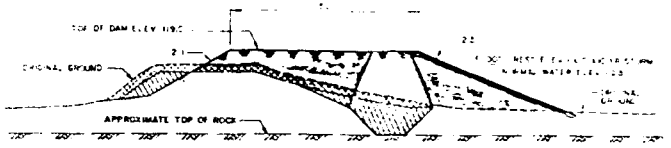
2-00



SECTION A - A THROUGH SPILLWAY



SECTION B - B THROUGH SPILLWAY



SECTION C - C THROUGH EARTH FILL

PLATE II

ELLIS POND PROJECT
NORWOOD, MASSACHUSETTS

ELLIS POND DAM

FAY, SPOFFORD & THORNDIKE, INC.

Jay, Spofford & Thorndike	B & J DRILLING	HOLE NO.	B-1
11 Beacon Street	25 WINDSOR ROAD	LINE & STA.	
Boston, Massachusetts	SUDBURY, MASS. 01776	OFFSET	
JOB LOCATION	Norwood, Massachusetts	SURFACE ELEV.	
PROJECT NAME	Ellis Pond Area	WATER LEVEL	Ground Level
DATE STARTED	November 13, 1972	BORING FOREMAN	T. Smith
DATE FINISHED	November 13, 1972	INSPECTOR	R. MacLeod

HOLE NO. B-1

SCALE IN FEET	SAMPLE DEPTH FROM	SAMPLE DEPTH TO	30" BLOWS PER 6" ON SAMPLER	STRATA CHANGE	FIELD CLASSIFICATION AND REMARKS
	0	1.5'	7-5		Firm fine brown Sand,
			6	2.0'	some medium Sand & medium Gravel
5	5'	6.5'	27-33		Very compact coarse brown Sand, and medium to coarse Gravel
			38	8.0'	
					Very compact fine to medium gray Sand,
10	10'	10.5'	127	10.5'	some Clay and fine Gravel
					Bottom of Hole 10.5'
					Refusal 75 Blows 0" Penetration
					with 250 lb. weight on an open end AW rod
					WATER LEVEL Ground Level

REMARKS:

BLOW COUNT TAKEN WITH 140 LB. WEIGHT FALLING 30" ON 2" O.D. SPLIT SPOON UNLESS OTHERWISE SPECIFIED
PROPORTIONS USED: TRACE = 0 - 10%, SOME = 10 - 35%, AND = 35 - 50%

Fay, Spofford & Thorndike	**B & J DRILLING**	HOLE NO. B-2
11 Beacon Street	25 WINDSOR ROAD	LINE & STA.
Boston, Massachusetts	SUDBURY, MASS. 01776	OFFSET
JOB LOCATION	Norwood, Massachusetts	SURFACE ELEV.
PROJECT NAME	Ellis Pond Area	WATER LEVEL 7'6"
DATE STARTED	November 13, 1972	BORING FOREMAN T. Smith
DATE FINISHED	November 13, 1972	INSPECTOR R. MacLeod

SCALE IN FEET	SAMPLE DEPTH FROM	SAMPLE DEPTH TO	30" BLOWS PER 12"-6" ON SAMPLER	STRATA CHANGE	FIELD CLASSIFICATION AND REMARKS — HOLE NO. B-2
	0	1.5'	4-7 12		Firm fine brown Sand, some coarse Sand, trace of fine Gravel and organic Silt
5	5'	6.5'	11-10 8		
				8.0'	
10	10'	11.5'	2-3 2		Loose very fine brown Sand, some fine to medium Gravel, trace of organic Silt
15	15'	16.5'	7-6	16.5'	Bottom of Hole 16.5' Refusal 135 Blows 0" Penetration with 250 lb. weight on an open end AW rod
	No	Recovery			WATER LEVEL 7'6"

REMARKS:

BLOW COUNT TAKEN WITH 140 LB. WEIGHT FALLING 30" ON 2" O.D. SPLIT SPOON UNLESS OTHERWISE SPECIFIED
PROPORTIONS USED: TRACE = 0 - 10%, SOME = 10 - 35%, AND = 35 - 50%

Fay, Spofford & Thorndike	**B & J DRILLING**	HOLE NO. B-2A
11 Beacon Street	25 WINDSOR ROAD	LINE & STA. Moved 7' from B-7
Boston, Massachusetts	SUDBURY, MASS. 01776	OFFSET
JOB LOCATION	Norwood, Massachusetts	SURFACE ELEV.
PROJECT NAME	Ellis Pond Area	WATER LEVEL 7'6"
DATE STARTED	November 13, 1972	BORING FOREMAN T. Smith
DATE FINISHED	November 13, 1972	INSPECTOR R. MacLeod

HOLE NO. B-2A

SCALE IN FEET	SAMPLE DEPTH FROM	SAMPLE DEPTH TO	30" BLOWS PER 12"6" ON SAMPLER	STRATA CHANGE	FIELD CLASSIFICATION AND REMARKS
	0	1.5'	4-7 14		Firm medium brown Sand, some fine to coarse Gravel, trace of organic Silt
5	5'	6.5'	10-10 11		
				9.0"	
10	10'	11.5'	5-5 3		Loose very fine dark brown Sand, some organic Silt, and fine to medium Gravel
15	15'	16.5'	4-8	16'7"	
	No Recovery				Bottom of Hole 16'7" Refusal 75 Blows 0" Penetration with 250 lb. weight on an open end AW rod WATER LEVEL 7'6"

REMARKS:

BLOW COUNT TAKEN WITH 140 LB. WEIGHT FALLING 30" ON 2" O.D. SPLIT SPOON UNLESS OTHERWISE SPECIFIED
PROPORTIONS USED: TRACE = 0 - 10%, SOME = 10 - 35%, AND = 35 - 50%

Fay, Spofford & Thorndike	**B & J DRILLING**	HOLE NO. B-3
11 Beacon Street	25 WINDSOR ROAD	LINE & STA.
Boston, Massachusetts	SUDBURY, MASS. 01776	OFFSET
JOB LOCATION	Norwood, Massachusetts	SURFACE ELEV.
PROJECT NAME	Ellis Pond Area	WATER LEVEL 1'0"
DATE STARTED	November 13, 1972	BORING FOREMAN T. Smith
DATE FINISHED	November 13, 1972	INSPECTOR R. MacLeod

SCALE IN FEET	SAMPLE DEPTH FROM	SAMPLE DEPTH TO	30" BLOWS PER 6" ON SAMPLER	STRATA CHANGE	FIELD CLASSIFICATION AND REMARKS — HOLE NO. B-3
	0	1.5'	7-10 6		Firm medium brown Sand, some fine to medium Gravel
5	5'	6.5'	9-8 11		
	8.5'	10'	4 5-3	8.5' 10.0'	Loose fine dark brown Sand, some fine to medium Gravel
10	10'	11.5'	27-38 64		Very compact fine gray Sand, some Silt and fine Gravel
				13.5'	Bottom of Hole 13.5' Refusal 120 Blows 0" Penetration with 250 lb. weight on an open end AW rod WATER LEVEL 1'0"

REMARKS:

BLOW COUNT TAKEN WITH 140 LB. WEIGHT FALLING 30" ON 2" O.D. SPLIT SPOON UNLESS OTHERWISE SPECIFIED
PROPORTIONS USED: TRACE = 0 - 10%, SOME = 10 - 35%, AND = 35 - 50%

Fay, Spofford & Thorndike	**B & J DRILLING**	HOLE NO.	B-4
11 Beacon Street	25 WINDSOR ROAD	LINE & STA.	
Boston, Massachusetts	SUDBURY, MASS. 01776	OFFSET	
JOB LOCATION	Norwood, Massachusetts	SURFACE ELEV.	
PROJECT NAME	Ellis Pond Area	WATER LEVEL	4" Above Ground
DATE STARTED	November 15, 1972	BORING FOREMAN	T. Smith
DATE FINISHED	November 15, 1972	INSPECTOR	R. MacLeod

SCALE IN FEET	SAMPLE DEPTH FROM	SAMPLE DEPTH TO	30" BLOWS PER 6" ON SAMPLER	STRATA CHANGE	HOLE NO. B-4 FIELD CLASSIFICATION AND REMARKS
	0	1.5'	7-14 11		Firm medium brown Sand, some coarse Sand, and fine to medium Gravel
5	5'	6.5'	7-6 6	7.0'	
					Compact fine brown Sand, some fine to medium Gravel, trace of Silt
10	10'	11.5'	14-21 17		
				15.0'	
15	15'	16.5'	31-48 110	16.5'	Very compact fine brown Sand, some medium and coarse Gravel
					Bottom of Hole 16.5' Refusal 125 Blows 0" Penetration with 250 lb. weight on an open end AW rod
					WATER LEVEL 4" Above Ground

REMARKS:

BLOW COUNT TAKEN WITH 140 LB. WEIGHT FALLING 30" ON 2" O.D. SPLIT SPOON UNLESS OTHERWISE SPECIFIED
PROPORTIONS USED: TRACE = 0 - 10%. SOME = 10 - 35%. AND = 35 - 50%

Fay, Spofford & Thorndike	**B & J DRILLING**	HOLE NO. B-5
11 Beacon Street	25 WINDSOR ROAD	LINE & STA.
Boston, Massachusetts	SUDBURY, MASS. 01776	OFFSET
JOB LOCATION	Norwood, Massachusetts	SURFACE ELEV.
PROJECT NAME	Ellis Pond Area	WATER LEVEL 1'0"
DATE STARTED	November 15, 1972	BORING FOREMAN T. Smith
DATE FINISHED	November 15, 1972	INSPECTOR R. MacLeod

SCALE IN FEET	SAMPLE DEPTH FROM	SAMPLE DEPTH TO	30" BLOWS PER 12"-6" ON SAMPLER	STRATA CHANGE	FIELD CLASSIFICATION AND REMARKS — HOLE NO. B-5
	0	1.5'	5-14 13		Firm fine brown Sand, Silt and fine to medium Gravel, some Cobbles
	3.5'	5'	39-68 126	3.5"	
5					Very compact fine brown Sand, some Silt and fine to medium Gravel, occasional Cobble
	7.5'	8'	125	8.0"	Bottom of Hole 8.0' Refusal 100 Blows 0" Penetration with 250 lb. weight on an open end AW rod
					WATER LEVEL 1'-0"

REMARKS:

BLOW COUNT TAKEN WITH 140 LB. WEIGHT FALLING 30" ON 2" O.D. SPLIT SPOON UNLESS OTHERWISE SPECIFIED
PROPORTIONS USED: TRACE = 0 - 10%, SOME = 10 - 35%, AND = 35 - 50%

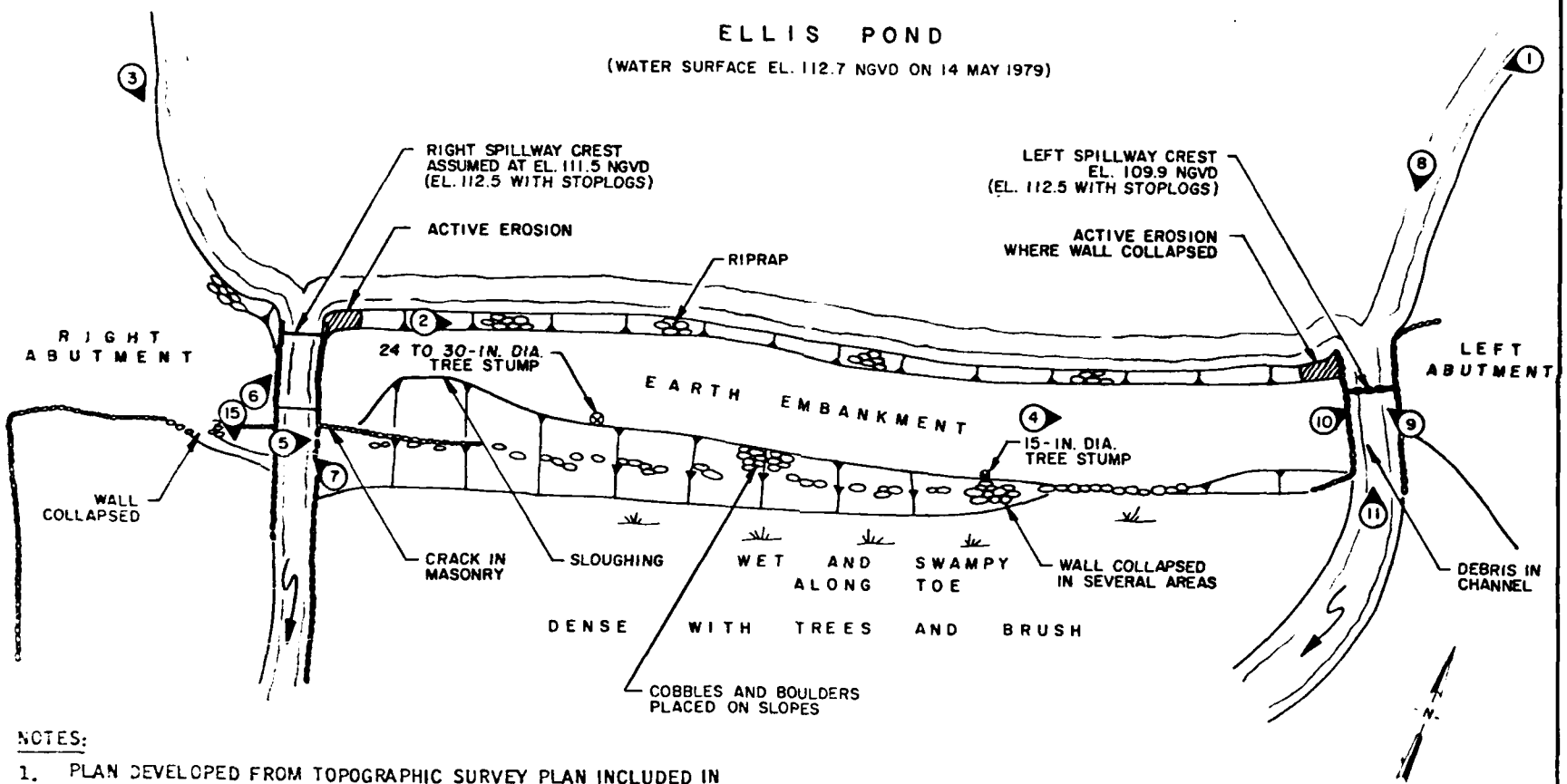
Fay, Spofford & Thorndike	**B & J DRILLING**	HOLE NO. B-7
11 Beacon Street	25 WINDSOR ROAD	LINE & STA.
Boston, Massachusetts	SUDBURY, MASS. 01776	OFFSET
JOB LOCATION	Norwood, Massachusetts	SURFACE ELEV.
PROJECT NAME	Ellis Pond Area	WATER LEVEL 2'6"
DATE STARTED	November 13, 1972	BORING FOREMAN T. Smith
DATE FINISHED	November 13, 1972	INSPECTOR R. MacLeod

SCALE IN FEET	SAMPLE DEPTH FROM	SAMPLE DEPTH TO	30" BLOWS PER 6" ON SAMPLER	STRATA CHANGE	FIELD CLASSIFICATION AND REMARKS — HOLE NO. B-7
	0	1.5'	1-1		6" Topsoil
			1		Very soft fine to medium brown
				3.0'	Sand, some Silt
5	5'	6.5'	47-53		Very compact fine gray-brown Sand, some Silt and fine Gravel
			92	6.5'	
					Bottom of Hole 6.5'
					Refusal 100 Blows 0" Penetration
					with 250 lb. weight on an open end AW rod
					WATER LEVEL 2'6"
					Remark: Sample #2 taken with 250 lb. weight on an open end AW rod.

REMARKS:

BLOW COUNT TAKEN WITH 140 LB. WEIGHT FALLING 30" ON 2" O.D. SPLIT SPOON UNLESS OTHERWISE SPECIFIED
PROPORTIONS USED: TRACE = 0 - 10%, SOME = 10 - 35%, AND = 35 - 50%

APPENDIX C - PHOTOGRAPHS



NOTES:

1. PLAN DEVELOPED FROM TOPOGRAPHIC SURVEY PLAN INCLUDED IN 1973 REPORT BY FAY, SPOFFORD & THORNDIKE, INC. (SEE PAGE B-31) AND OBSERVATIONS AND ROUGH MEASUREMENTS MADE ON 14 MAY 1979.

LEGEND

(4) PHOTO NO. AND DIRECTION OF VIEW

Ellis Pond Dam
Norwood, MA

SITE PLAN SKETCH

Approx. Scale 1"=30' July 1979

FILE NO 4270 839

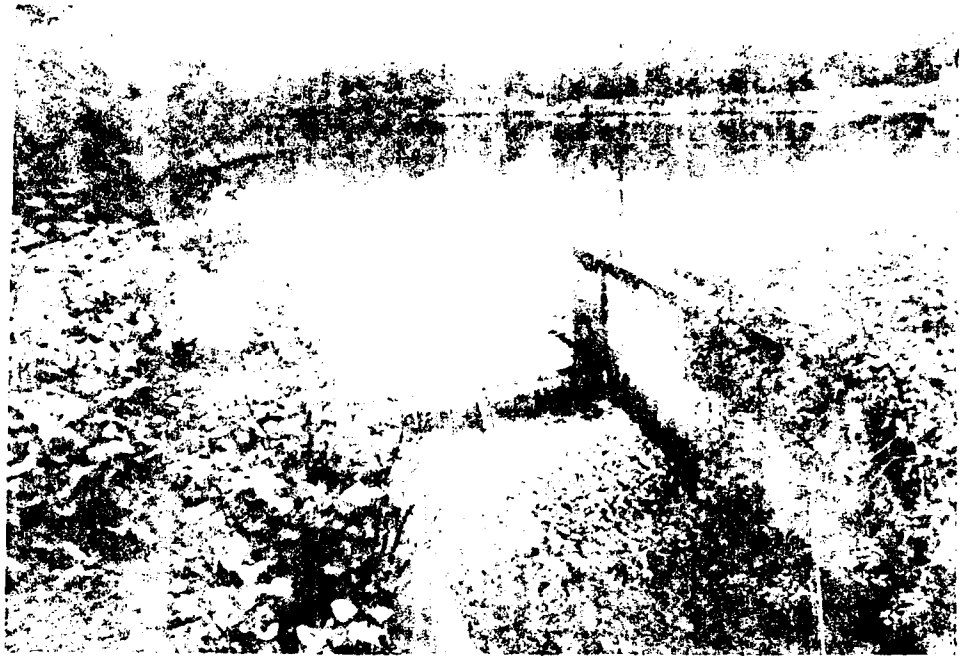
HALEY & ALDRICH, INC.
CAMBRIDGE, MASSACHUSETTS

2. Upstream slope of earth embankment

3. Upstream slope adjacent to right (west) spillway

4. Crest of earth embankment

5. Downstream side of earth embankment. Note crack in masonry, toppled walls, dense vegetation and tree trunk sections



6. Right (west) spillway and reservoir area

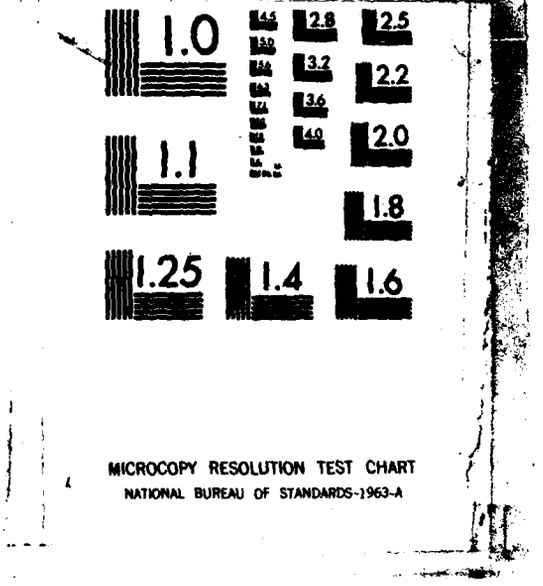
7. Right wall and cascade at downstream end of right (west) spillway

8. Left (east) spillway and actively eroding upstream slope of earth embankment

9. Right wall of left (east) spillway

AD-A154 329 NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS 2/2
ELLIS POND DAM (MA 00.. (U) CORPS OF ENGINEERS WALTHAM
MA NEW ENGLAND DIV JUL 79

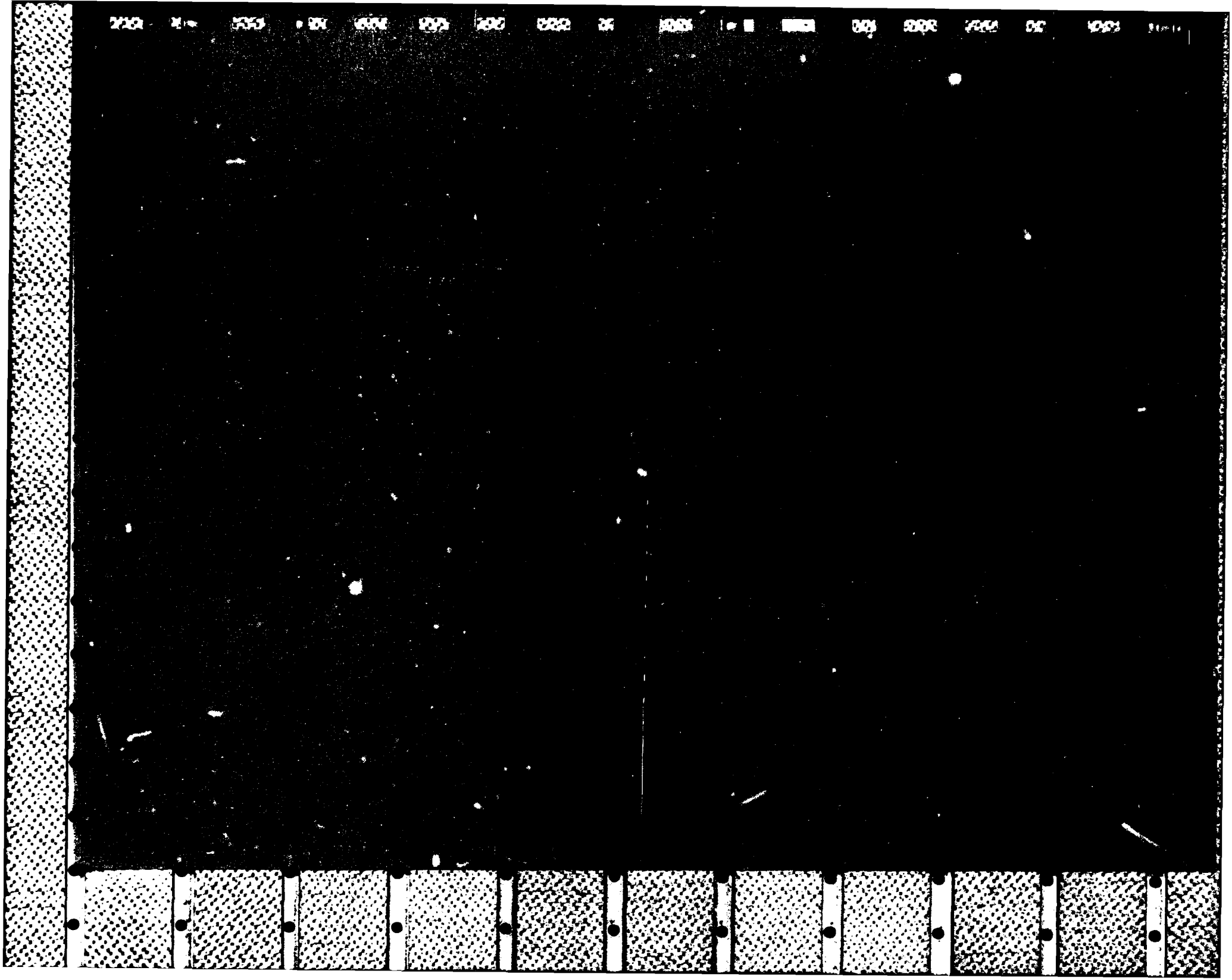
UNCLASSIFIED F/G 13/13 NL


1.0
1.1
1.25
1.4
1.6
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

10. Left wall of left (east) spillway

11. Downstream end and channel of left (east) spillway

12. Downstream channel and shopping center below right (west) spillway



CAMP DRESSER & McKEE Inc.
Consulting Engineers
Boston, Mass.

ELLIS POND DAM
DRAINAGE & FLOOD IMPACT AREAS
SCALE 1:24,000

CAMP DRESSER & McKEE Environmental Engineers Boston, Mass.

CLIENT Haley and Aldrich JOB NO 561-9-R+-15 PAGE 1

PROJECT COE Dam Inspections DATE CHECKED 6/12/79 DATE 6/11/79

DETAIL Ellis Pond Dam - Norwood CHECKED BY AHG COMPUTED BY RHS

Size Classification

Height of dam = 116.5-100.5 = 16.0' < 40' (Small)

Storage at top of dam = 540 acre-ft. < 1000 acre-ft. (Small)

Size Classification: SMALL

Hazard Potential

Development downstream from the dam is extensive and consists of apartment buildings, factories, warehouses, and a shopping center. The shopping center is separated from the stream embankment by a paved parking lot and contains eleven business establishments: one supermarket, one department store, one bank, and eight small stores. During a dam failure, Walpole Street (Route 1-A) would be significantly flooded as would the downstream shopping center, apartments, warehouses, and factories. Because of the potential for lost lives and property damages, the hazard potential classification is HIGH.

Test Flood

Drainage Area = 5,120 acres. = 8 sq. mi.
Most of the terrain is assumed to be flat-coastal.

From COE Guidelines (with interpolation): Peak Flow Rate: 750 cfs/sq.mi.

PMF = 750 cfs/sq.mi. X 8 sq.mi. = 6,000 cfs

Test Flood Inflow: High hazard and small dam → ½ PMF — PMF

After a review of the downstream conditions in general, a peak flow corresponding to ½ PMF (=3000 cfs) was selected for further studies.

Surcharge Storage Routing at Ellis Pond

Assumptions: 1. No reduction in flow due to storage in Willett Pond. The U.S.G.S. topographic quadrangle map shows Willett Pond WSE @ 139 ft. and shoreline elevation @ 140 ft. and sloping down and away from pond. Therefore, storage capacity is minimal.
2. Spillway level is at top of stoplogs as witnessed during field inspection.

Test Flood Inflow at Ellis Pond Dam = 3,000 cfs
WSE @ Ellis Pond Dam @ 3,000 cfs = 117.9 ft. (See Stage-Discharge, page D-5)
Volume @ Ellis Pond @ 117.9 ft. = 660 ac.-ft. (See Area-Volume, page D-6)

Normal Pond Volume @ 112.5 ft. = 275 ac.-ft.

$STOR\,1 = \left(\frac{660-275}{3120}\right) \times 12 = 0.90$ in.
Trial $Q_{P2} = 8000\left(1-\frac{0.90}{9.5}\right) = 2716$ cfs → WSE = 117.8 ft., Vol. = 650 ac.-ft.
$STOR\,2 = \left(\frac{650-275}{3120}\right) \times 12 = 0.88$ in.
$STOR_{av} = 0.89$ in

$Q_{P2} = 3000\left(1-\frac{0.89}{9.5}\right) = 2,719$ cfs → WSE = 117.8 ft., Vol. = 650 ac.-ft.
$STOR\,3 = \left(\frac{650-275}{3120}\right) \times 12 = 0.88$ in
$STOR_{av} = 0.89$ in

Test Flood Outflow = 2,719 cfs, say 2700 cfs

Pond WSE = 117.8 ft.

Test Flood water surface elevation is 1.3 feet above top of dam.

Tailwater:

Q = 2,700 cfs
WSE downstream of dam = 106.6 ft. (See Stage-Discharge, page D-7)

El. 106.6 < 112.5 → Spillway crest (top of stoplogs) would not be submerged.

Spillway Capacity (See sketch on following page)
Left Spillway: $Q_L = 3.5 \times 11.2 \times (116.5 - 112.3)^{1.5} = 337$ cfs
Right Spillway: $Q_R = 3.5 \times 10.2 \times (116.5 - 112.5)^{1.5} = 286$ cfs
Total flow without overtopping the dam = 623 cfs
623/2700 = 0.23 = 23%

Total spillway capacity is approximately 23% of the estimated test flood outflow.

CAMP DRESSER & McKEE
Environmental Engineers
Boston, Mass.

CLIENT Haley and Aldrich | JOB NO 561-9-R4-15 | PAGE 3
PROJECT COE Dam Inspection | DATE CHECKED 6/18/79 | DATE 6/18/79
DETAIL Ellis Pond Dam - Nacmead | CHECKED BY AHG | COMPUTED BY RHS

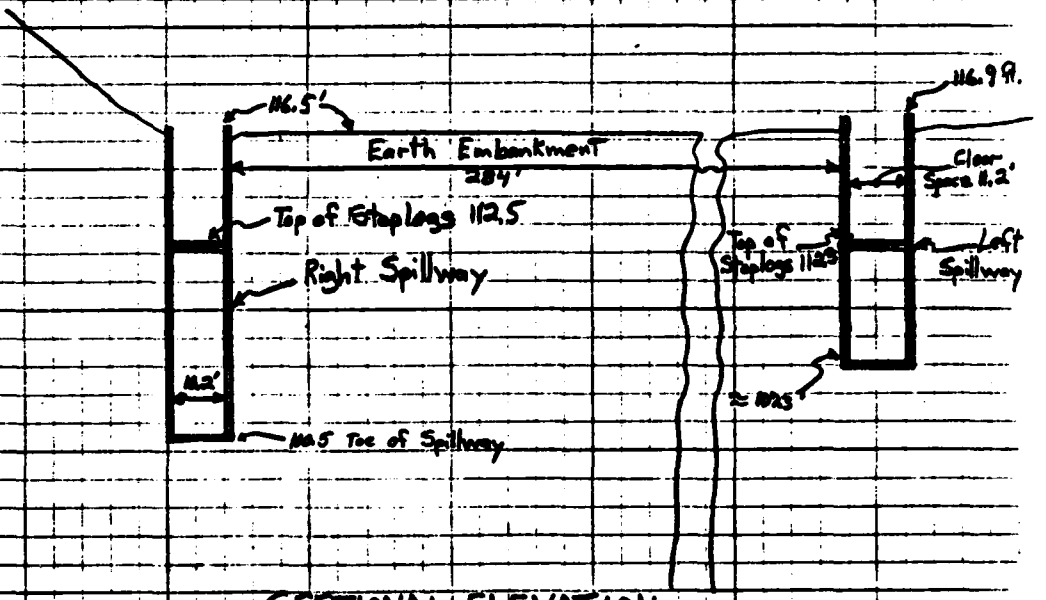
Spillway Capacities at Test Flood Elevations (See Sketch Below)

Left Spillway: $Q_L = c L H^{\frac{3}{2}} = 3.5 \times 11.2 \times (117.8 - 112.5)^{1.5} = 506$ cfs

Right Spillway: $Q_R = 3.5 \times 10.2 \times (117.8 - 112.5)^{1.5} = 436$ cfs

$\Sigma Q = 506 + 436 = 942$ cfs, say 940 cfs

The remaining 1,760 cfs (2700 − 940) would be discharged over the dam embankment and the banks.



SECTIONAL ELEVATION

(Looking Upstream)

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Boston, Mass.

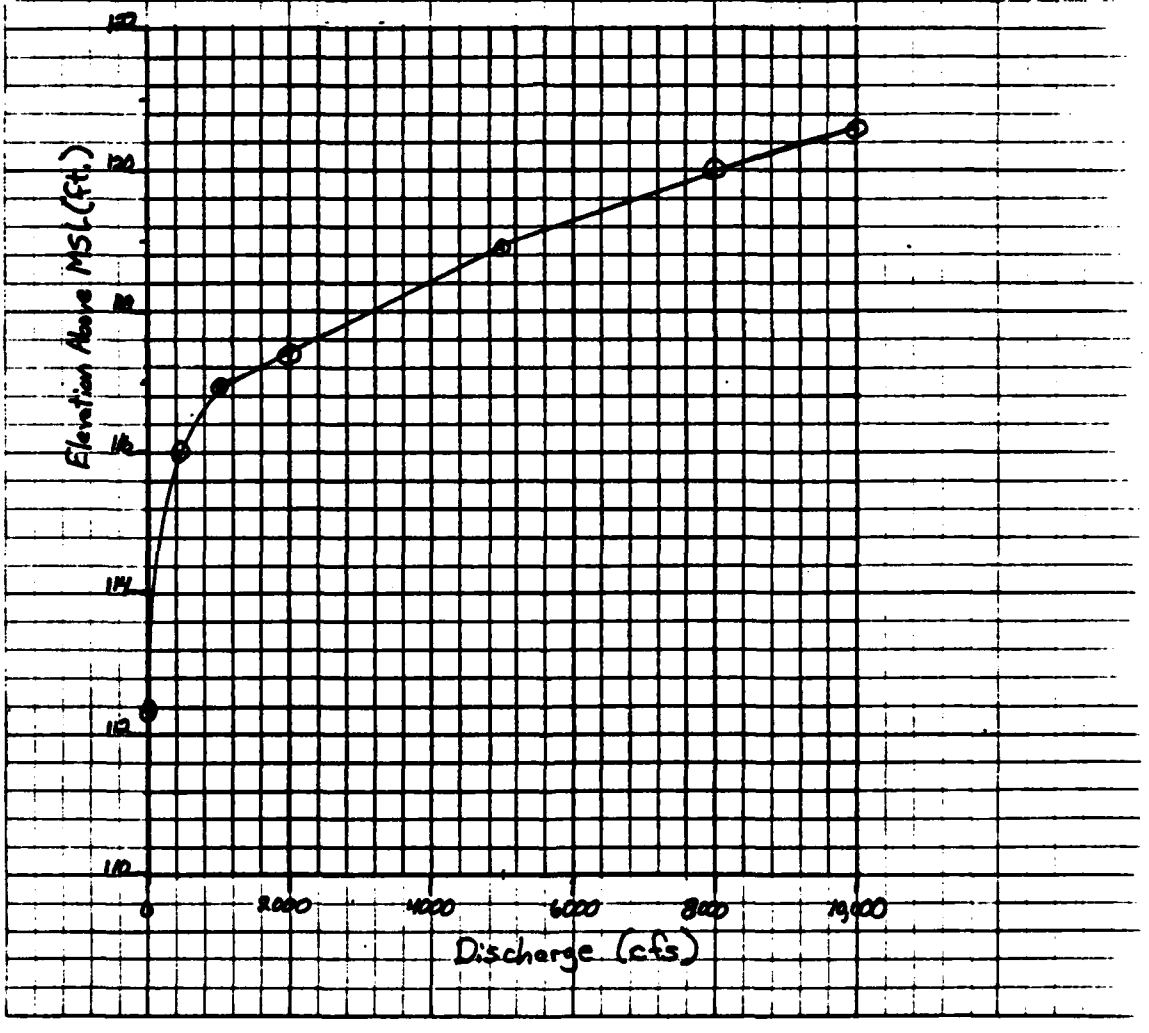
CLIENT Haley and Aldrich
PROJECT COE Dam Inspection
DETAIL Ellis Pond Dam - Norwood

JOB NO 561-9-81-15
DATE CHECKED 6/18/79
CHECKED BY AHG

PAGE 4
DATE 6/11/79
COMPUTED BY RHS

STAGE-DISCHARGE CURVE - ELLIS POND

Discharge (cfs)	Pond Elevation (ft.)
0	112.3
500	116.0
1600	116.9
2000	117.6
5000	118.9
8000	120.0
14000	120.6



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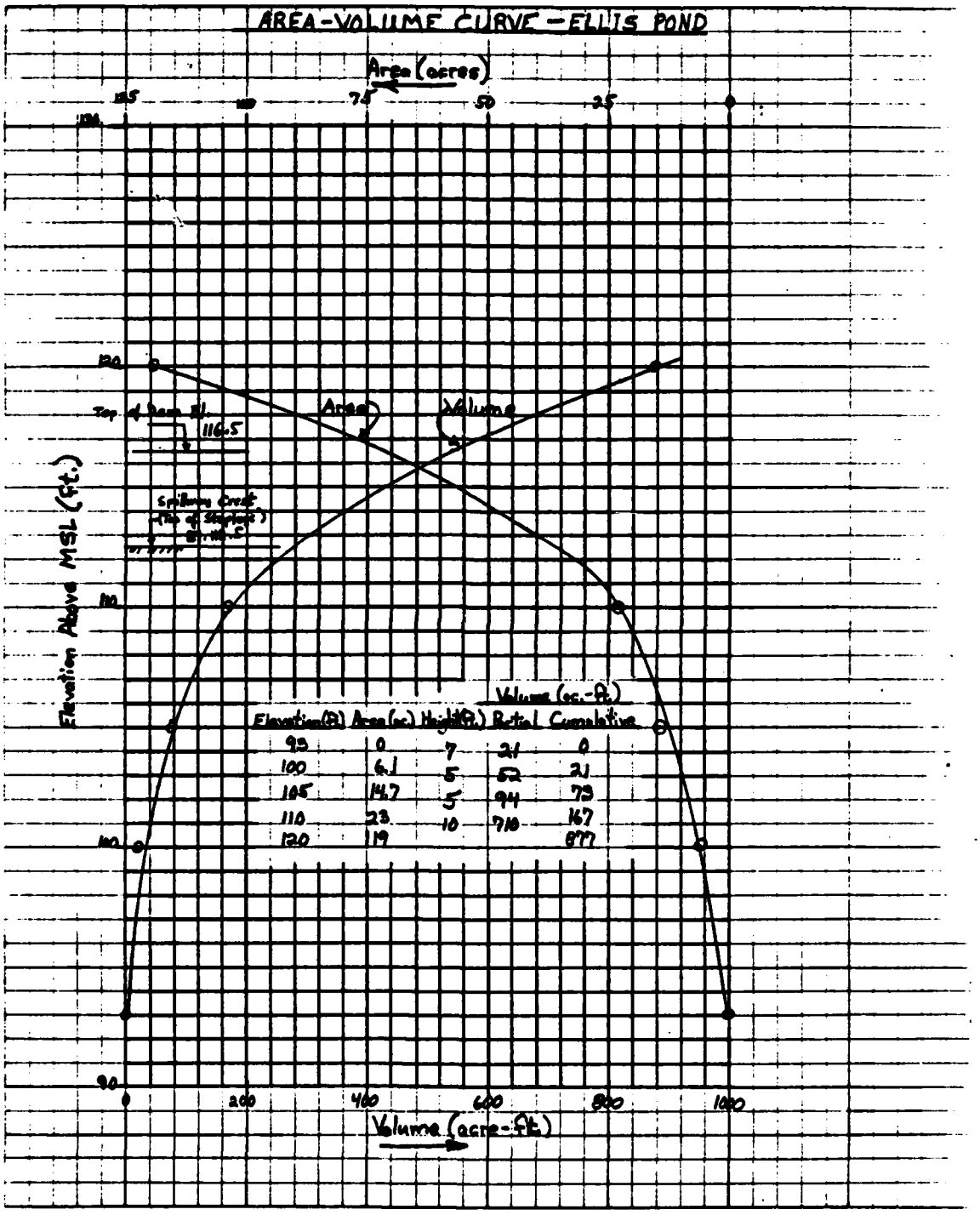
Boston, Mass.

CLIENT Haley and Aldrich
PROJECT COE Dam Inspection
DETAIL Ellis Pond Dam - Norwood

JOB NO 51-9-Rt-15
DATE CHECKED 6/18/79
CHECKED BY AUG

PAGE 5
DATE 6/14/79
COMPUTED BY RHS

AREA-VOLUME CURVE - ELLIS POND



Elevation (ft)	Area (ac)	Height (ft)	Volume (ac.-ft.) Partial	Cumulative
95	0	7	21	0
100	6.1	5	52	21
105	14.7	5	94	73
110	23	10	710	167
120	19			877

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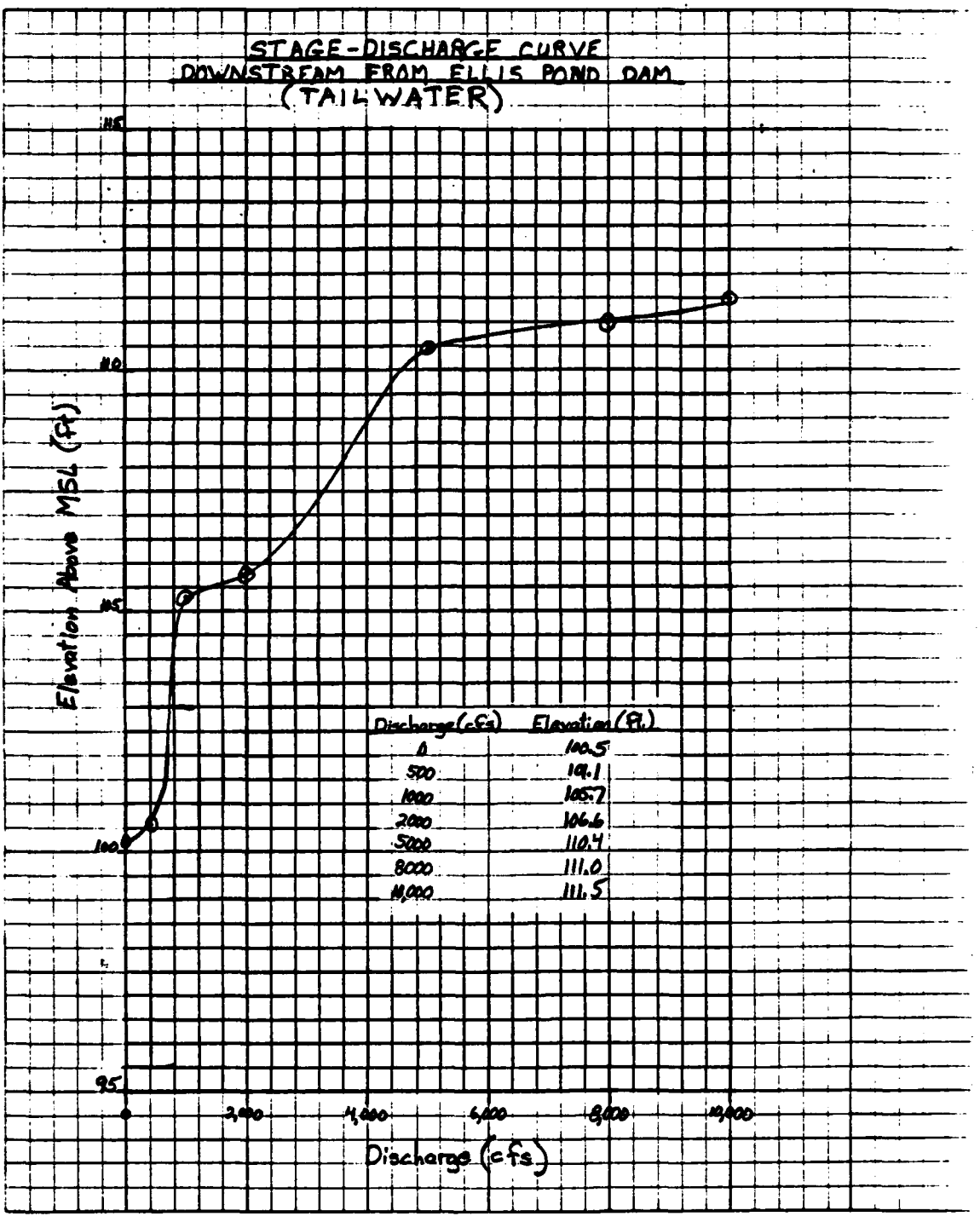
Environmental Engineers
Boston, Mass.

CLIENT Haley and Aldrich
PROJECT COE Dam Inspection
DETAIL Ellis Pond Dam - Norwood

JOB NO 561-9-R4-15
DATE CHECKED 6/18/79
CHECKED BY AHG

PAGE 6
DATE 6/6/79
COMPUTED BY RHS

STAGE-DISCHARGE CURVE
DOWNSTREAM FROM ELLIS POND DAM
(TAILWATER)



Discharge (cfs)	Elevation (ft.)
0	100.5
500	104.1
1000	105.7
2000	106.6
5000	110.4
8000	111.0
11,000	111.5

Dam Failure Analysis

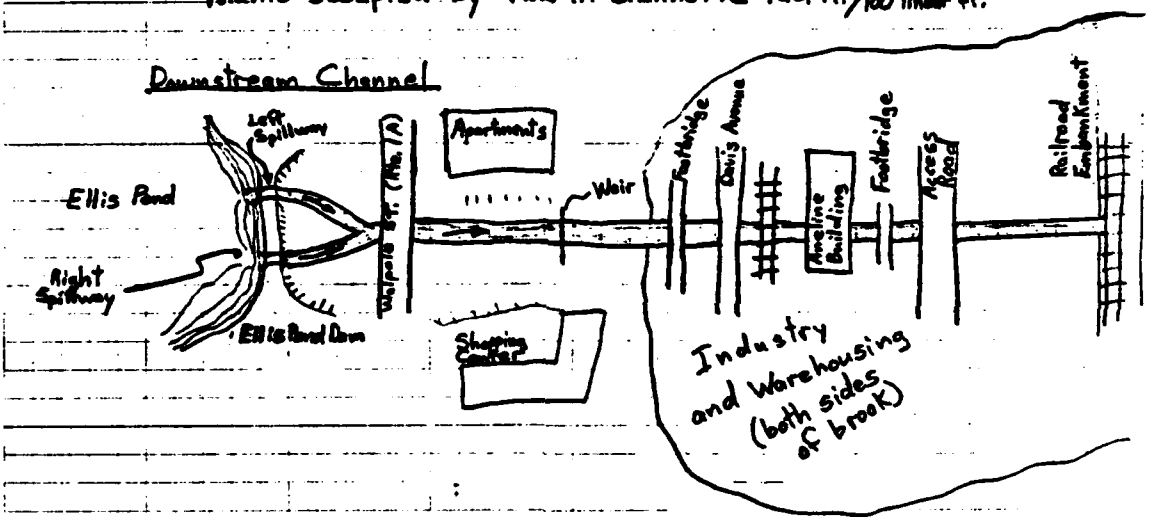
$Q_{P1} = 8/27\ W_b \sqrt{g}\ Y^{1.5}$

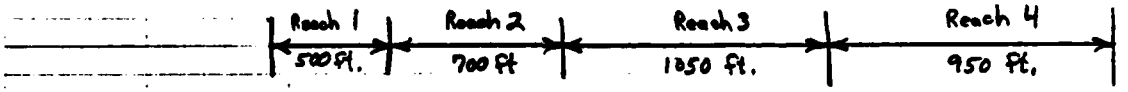
Assume: 1. Dam fails when WSE = 116.5 (at top of dam)
2. Flow before failure = 625 cfs
3. Breach width = 40% of earth dike between spillways = 0.4 × 284' = 113.6'
4. Height of dam = 15.5 ft.
5. Storage at failure = 540 ac.-ft. (See Area-Volume Curve, page D-6)

$Q_{P1} = 8/27 \times 0.4 \times 284 \times \sqrt{32.2} \times 15.5^{1.5} = 11,655$ cfs

Flow in channel before failure = 625 cfs (See Page D-3)
Volume occupied by flow in channel ≈ 1 ac.-ft./100 linear ft.

Downstream Channel





Reach 1: Ellis Pond Dam to Walpole Street (500 linear feet)

$Q_{P1} = 11,665 + 625 = 12,280$ cfs
Assume S = channel bottom slope = 0.0171 (Est. from USGS topo map)
n = 0.08 Volume from pond = 540 ac-ft.

$V_1 = 500\left(\frac{4935+2800}{2}\right)\frac{1}{43560} - 5 = 44 - 5 = 39$ ac-ft.

Q_{P2}(trial) $= 12,280\left(1-\frac{39}{540}\right) = 11,393$ cfs → WSE = 106.7; A = 2300

$V_2 = \left(\left(\frac{4935+2280}{2}\right)500\frac{1}{43560}\right) - 5 = 42 - 5 = 37$ ac-ft.

$V_{ave} = 38$ ac.-ft.

$Q_{P2} = 12,280\left(1-\frac{38}{540}\right) = 11,416$ cfs

At Walpole Street, $Q_{P2} = \underline{11,416}$, WSE = $\underline{106.7}$

Reach 2: Walpole St. to Weir (700 linear feet)

$Q_{p1} = 11,416$ cfs Volume = 540 − 38 = 502 ac-ft. ; n = 0.08

Slope (from USGS) = 0.0109

$V_1 = 700\left(\frac{3300+3240}{2}\right)\frac{1}{43560} - 7 = 45 - 7 = 38$ acre-feet

Q_{p2} (trial) $= 11416\left(1-\frac{38}{502}\right) = 10,552$ cfs → WSE = 10,552 ; A = 3120 s.f.

$V_2 = 700\left(\frac{3300+3120}{2}\right)\frac{1}{43,560} - 7 = 37$ acre-feet.

$V_1 = V_2 = V_{ave}$

At weir, $Q_{p2} = 10,552$ cfs and WSE = 94.8

Reach 3: Weir to Aneline Building (1050 linear feet)

$Q_{p1} = 10,552$ cfs Volume = 502 − 38 = 464 ac-ft. ; n = 0.075

Slope (from USGS) = 0.0050

$V_1 = 1050\left(\frac{3120+2300}{2}\right)\frac{1}{43560} - 10 = 65 - 10 = 55$ ac.-ft.

Q_{p2} (trial) $= 10,552\left(1-\frac{55}{464}\right) = 9301$ cfs → WSE = 86.5 ft ; A = 2400 ac-ft.

$V_2 = 1050\left(\frac{3120+2400}{2}\right)\frac{1}{43560} - 10 = 67 - 10 = 57$ ac.-ft.

$V_{ave} = 56$ ac-ft.

$Q_{p2} = 10552\left(1-\frac{56}{464}\right) = 9,278$ cfs

At Aneline Building, $Q_{p2} = 9,278$ cfs and WSE = 86.5 ft.

Reach 4: Aneline Building to RR embankment (950 ft.)

$Q_{p1} = 9278$ cfs Volume = 464 − 56 = 408 ac-ft. ; n = 0.065

Slope (from USGS) = 0.00125

$V_1 = 950\left(\frac{3100+2400}{2}\right)\frac{1}{43560} - 9 = 60 - 9 = 51$ ac.-ft.

Q_{p2} (trial) $= 9278\left(1-\frac{51}{408}\right) = 8118$ cfs → WSE = 78.1 ; A = 2850 ac.

$V_2 = 950\left(\frac{2850+2400}{2}\right)\frac{1}{43560} - 9 = 57 - 9 = 48$ ac-ft.

$Q_{p2} = 9278\left(1-\frac{50}{408}\right) = 8140$ cfs

At RR embankment, $Q_{p2} = 8140$ cfs and WSE = 78.1 ft.

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DETAIL Ellis Pond Dam - Normal | CHECKED BY AHG | COMPUTED BY RHS

Failure Flood Impact

A summary of potential flood impact from a dam failure is shown below:

Location	Type of Development	Depth of Flood Water (feet)
Walpole Street	Shopping center, garden apartments	4
Davis Avenue	Industry, warehousing	8

An approximate hydraulic profile of a flood wave from dam failure is shown on page D-11.

Note For the dam safety investigations, it is assumed that a failure would occur only at the dam which is under study and the other upstream and downstream facilities, such as dams and bridges, would remain intact; for example, we have not considered the effects on the dam under study which could be caused by failure of an upstream dam, especially a larger upstream dam.

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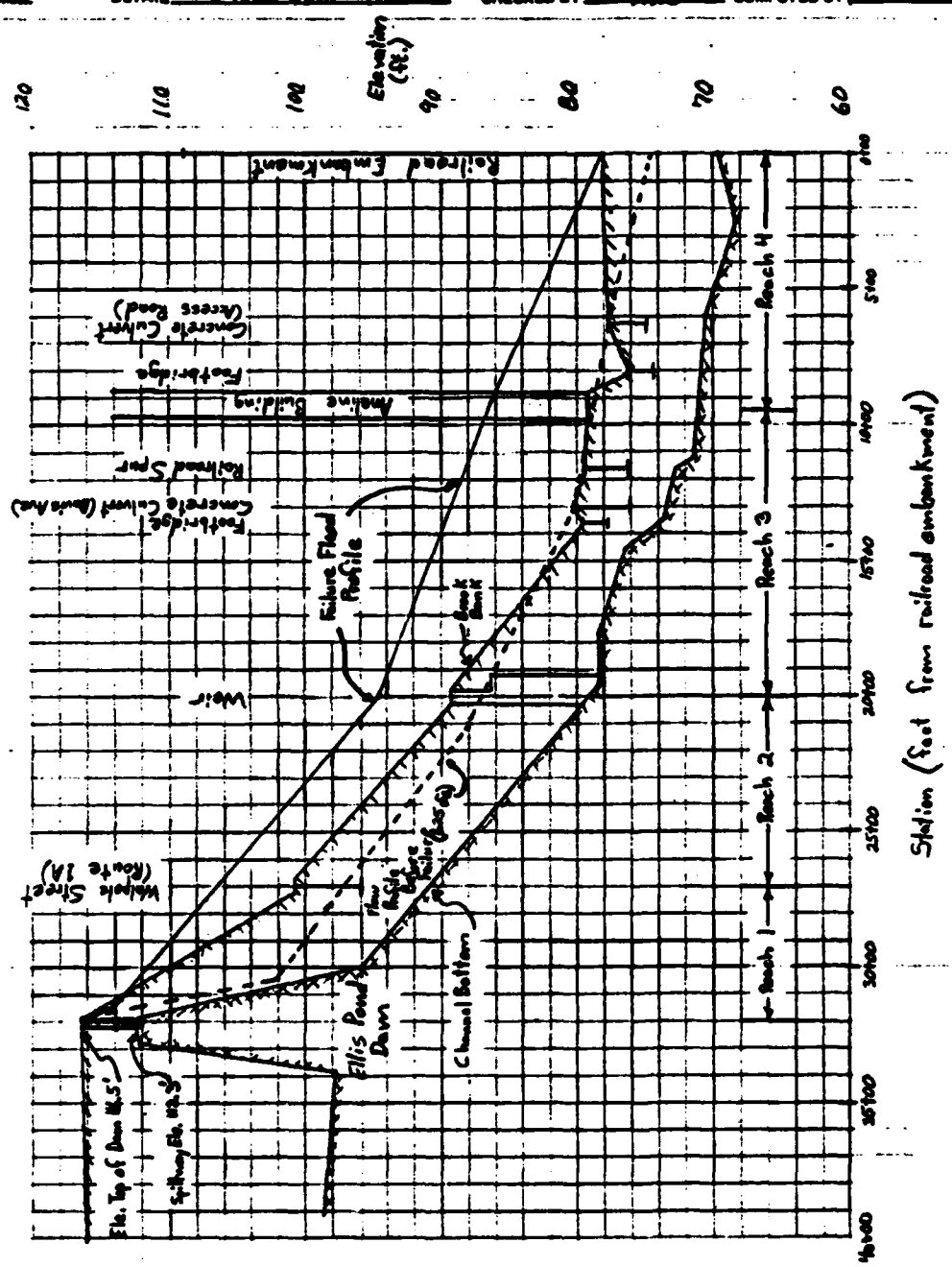
HAWES BROOK PROFILE
(approximate)



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DOWNSTREAM CHANNEL

SECTIONS AND CALCULATIONS

(TAILWATER COMPUTATIONS)

D-12

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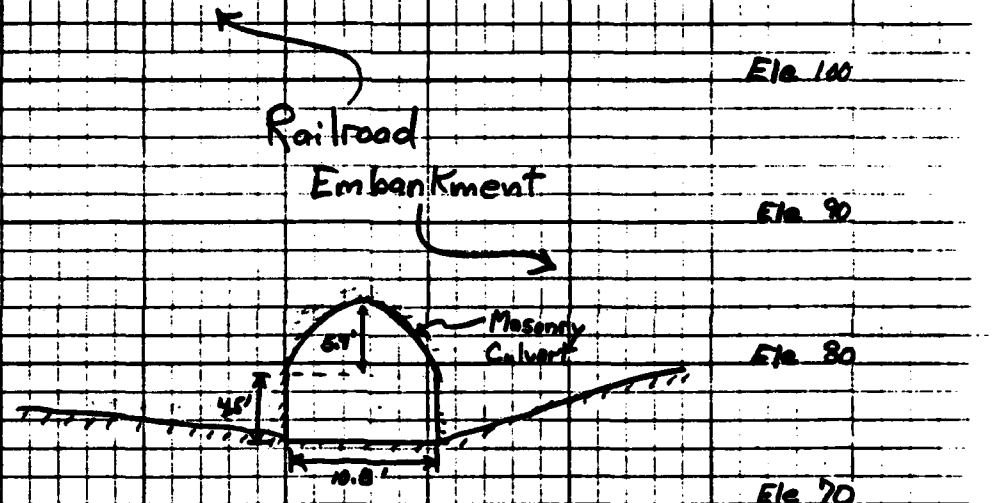
Station 0+00
Cross-Section

Location: Railroad embankment
Scale: Horizontal and Vertical 1" = 10'
View: Looking Upstream



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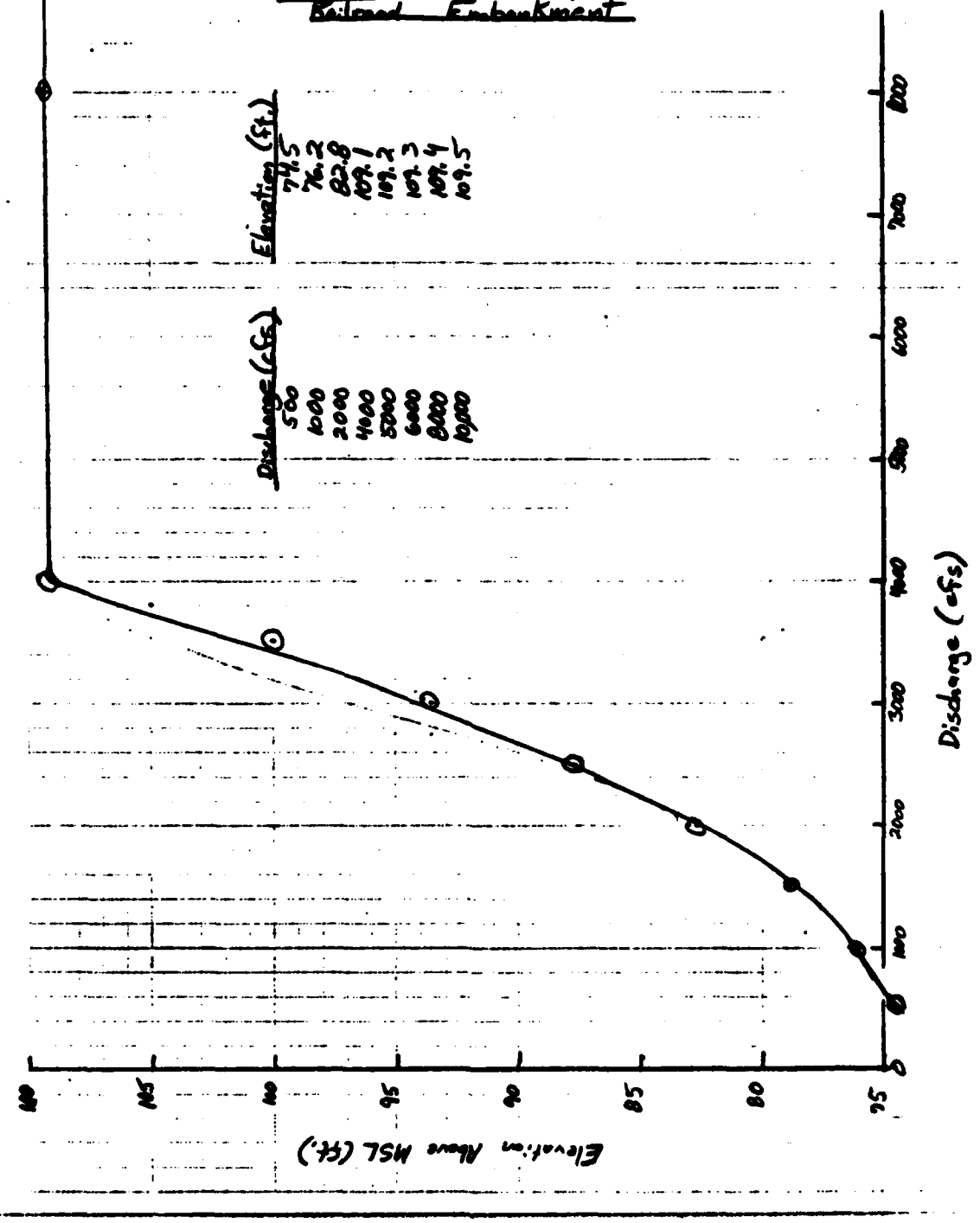
Stage - Discharge Curve
Railroad Embankment

Elevation (ft.)	Discharge (cfs)
74.5	500
76.2	1000
82.8	2000
88.1	4000
92.2	5000
97.3	6000
97.4	8000
99.5	10,000



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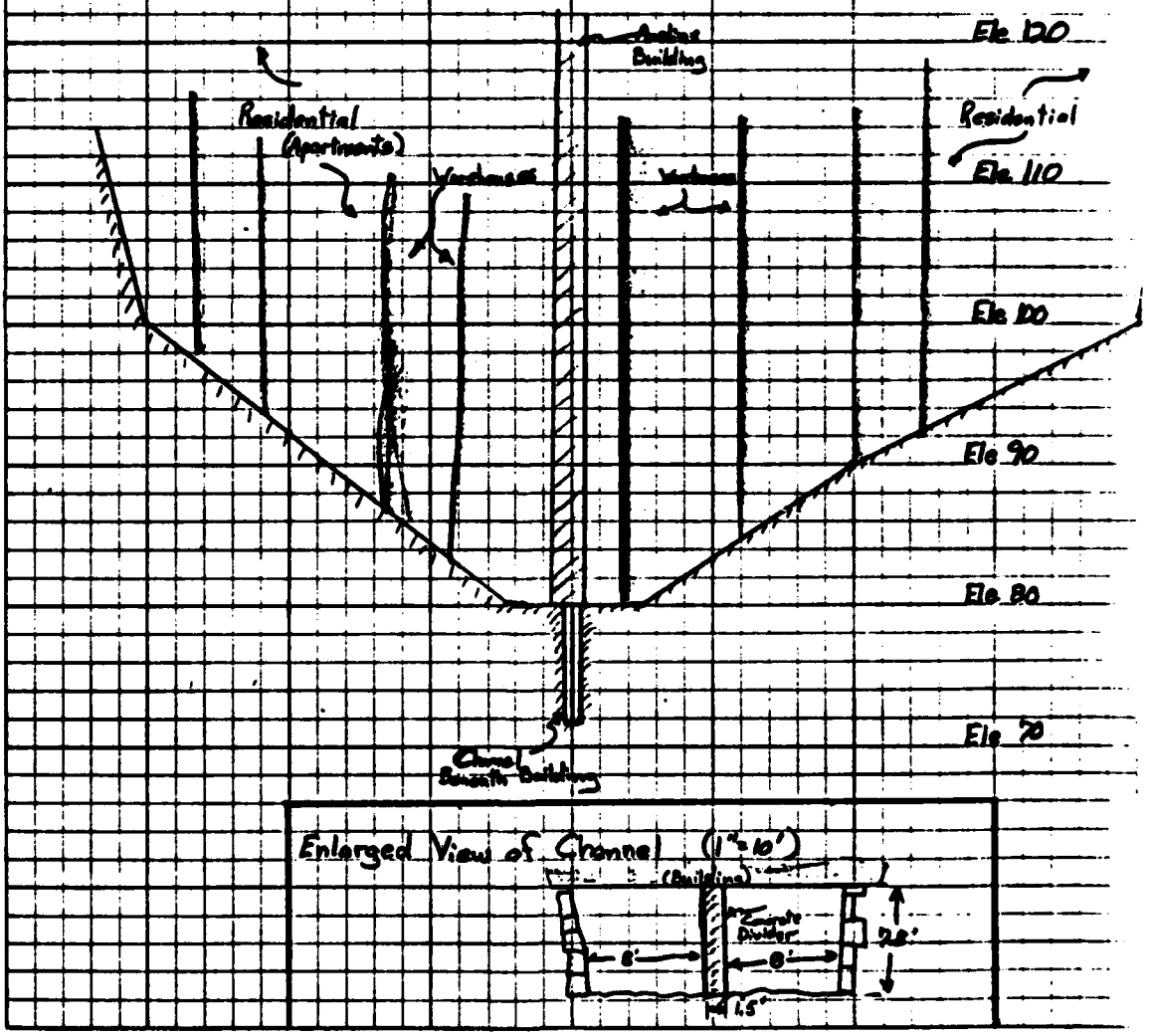
DETAIL Ellis Road Dam - Norwood | PAGE NO. 3

Station 9+50
Cross - Section

Location : At Avalon Building
Scale : Horizontal 1" = 50'
Vertical 1" = 10'
View : Looking Upstream



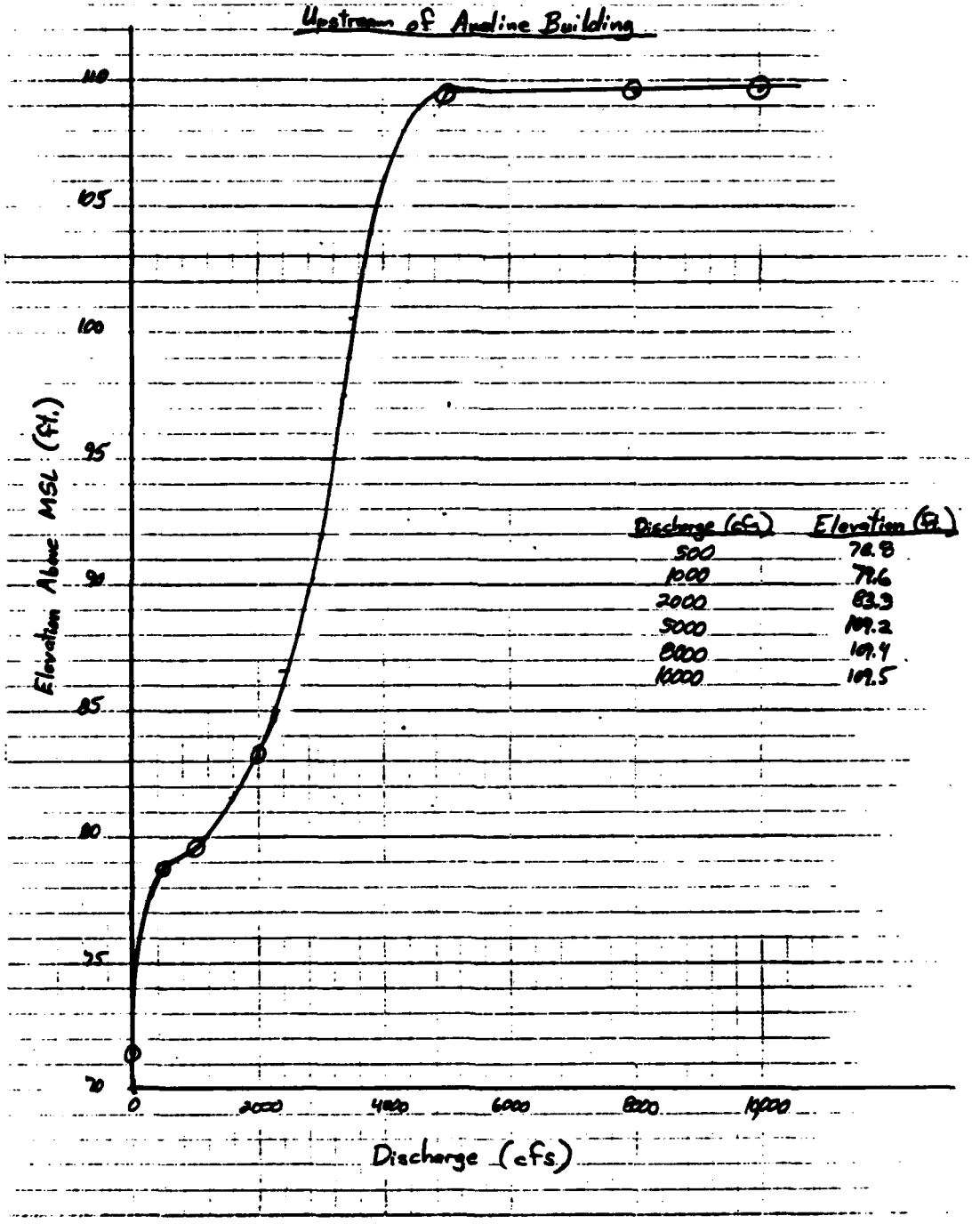
CLIENT Haley and Aldrich JOB NO 561-9-R1-15 PAGE 4

PROJECT CRE Dam Inspection DATE CHECKED DATE 5/24/79

DETAIL Ellis Road Dam - Norwood CHECKED BY COMPUTED BY RHS

Stage Discharge

Upstream of Aveline Building



Discharge (cfs)	Elevation (ft)
500	78.8
1000	79.6
2000	83.3
5000	109.2
8000	109.4
10000	109.5

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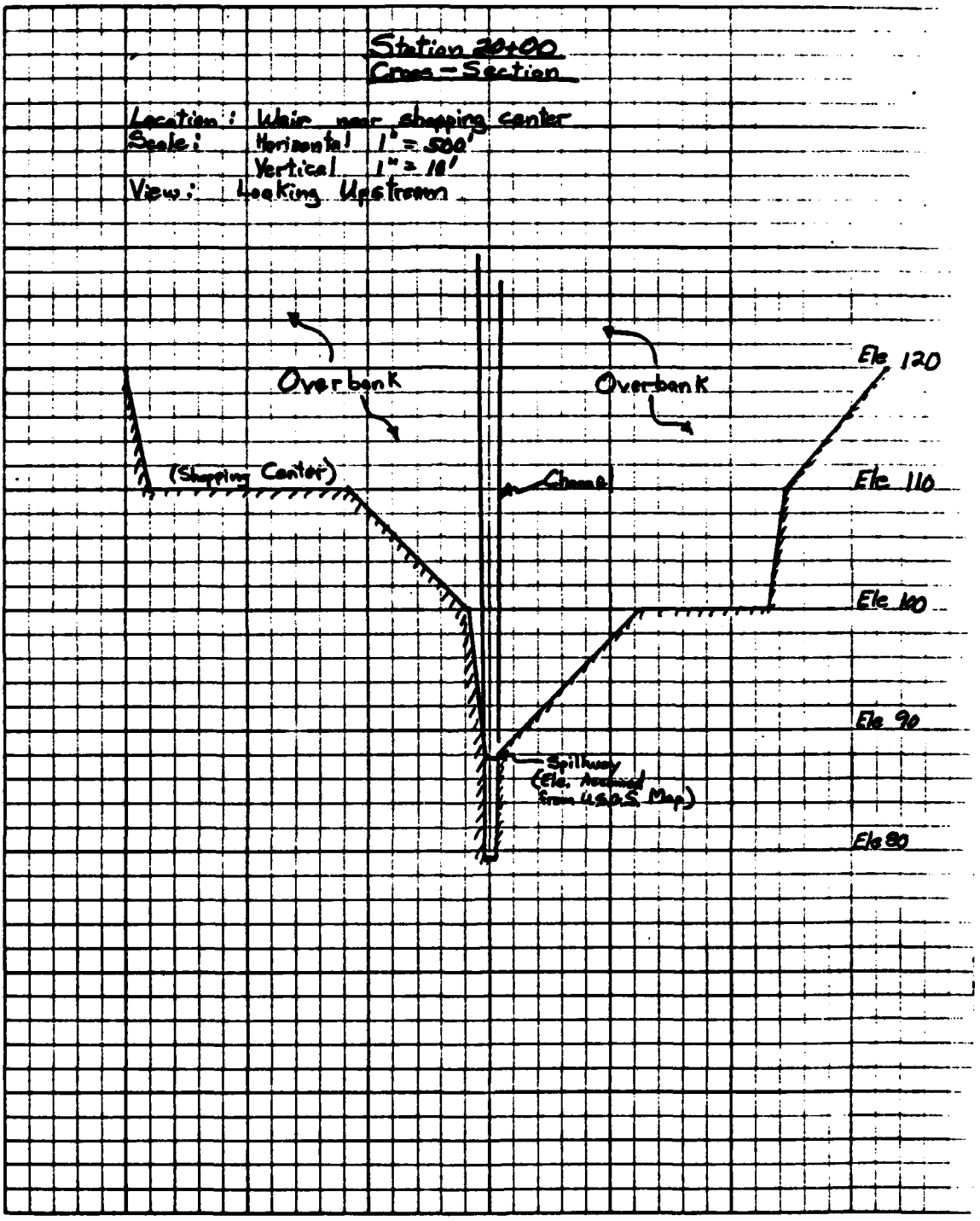
Station 20+00
Cross-Section

Location: Weir near shopping center
Scale: Horizontal 1" = 500'
Vertical 1" = 10'
View: Looking Upstream



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PROJECT GBR Dam Inspections DATE CHECKED DATE

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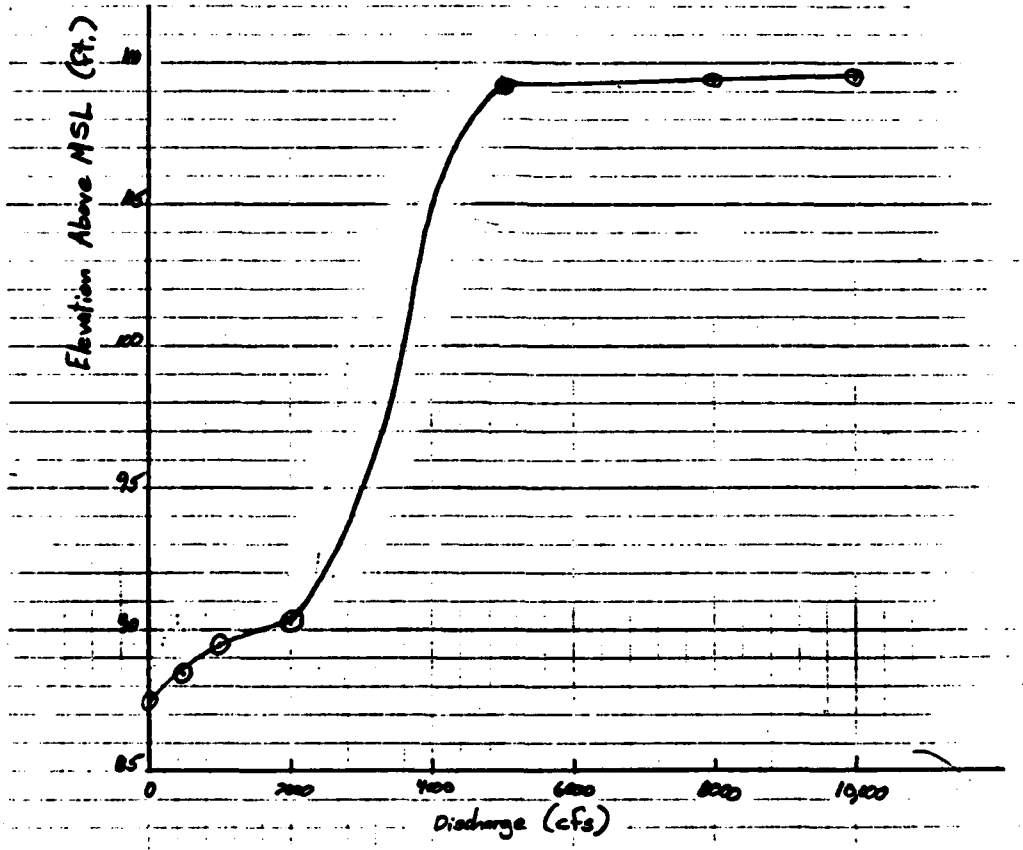
Stage - Discharge Upstream of Spillway at Shopping Center

Station 20+00



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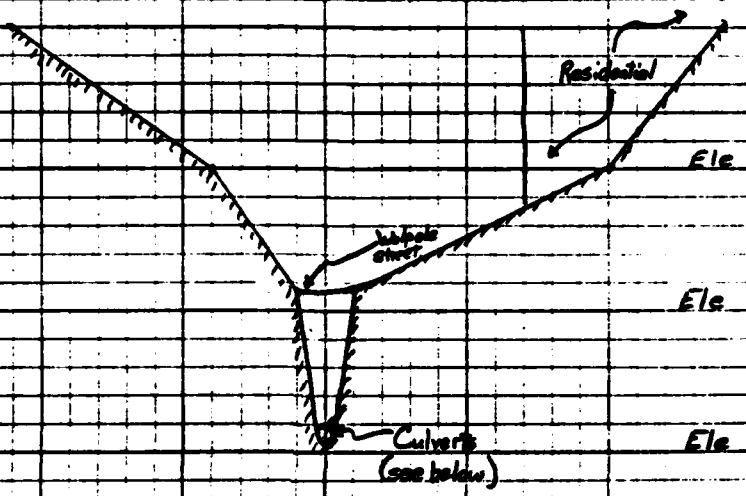
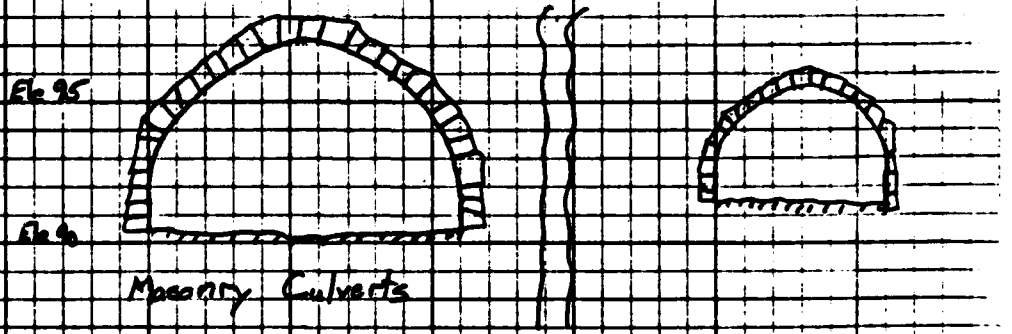
Station 27+00
Cross-Section

Location: Walpole Street
Scale: Horizontal 1"=25'
Vertical 1"=10'



Enlargement
Scale: Horizontal and Vertical 1"=5'



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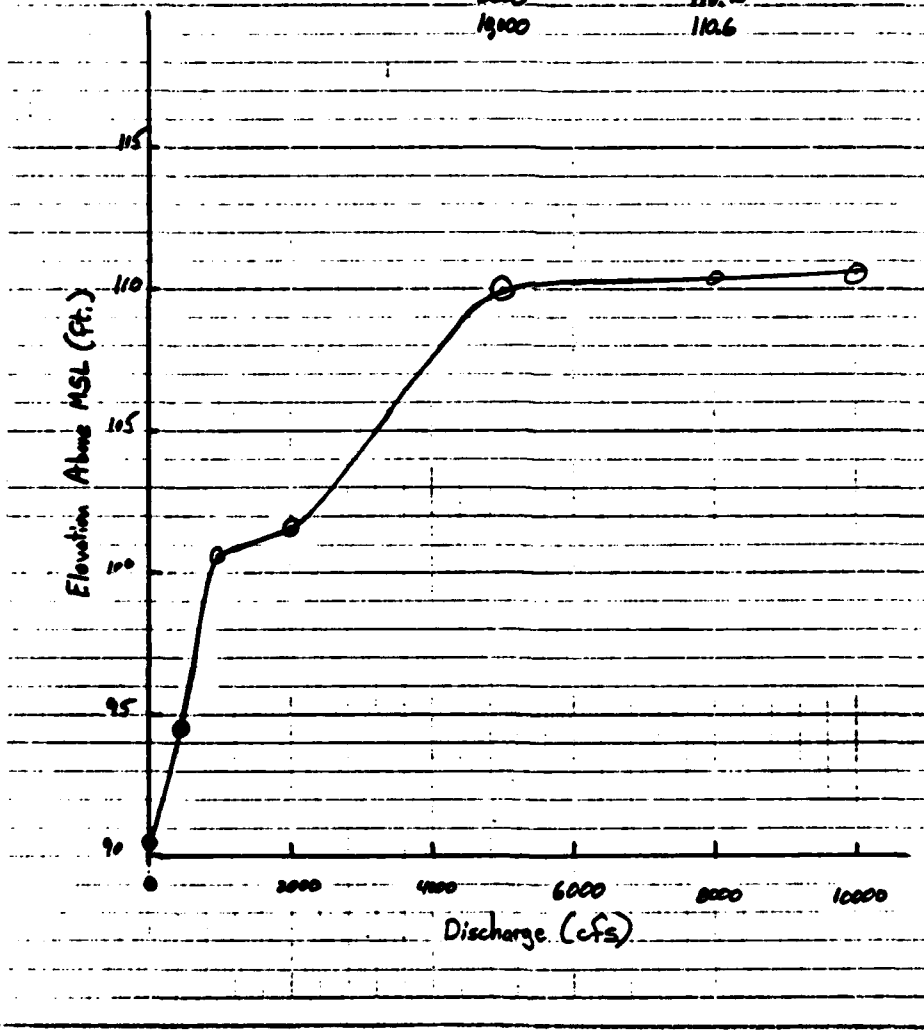
PROJECT FERC Dam Inspection DATE CHECKED DATE 5/31/79

DETAIL Mills Pond Dam - Norwood CHECKED BY COMPUTED BY RHS

Stage - Discharge Upstream of Whpole Street

Station 27+00

Discharge (cfs)	Elevation (ft)
500	94.6
1000	100.7
2000	101.6
5000	110.0
8000	110.3
10,000	110.6



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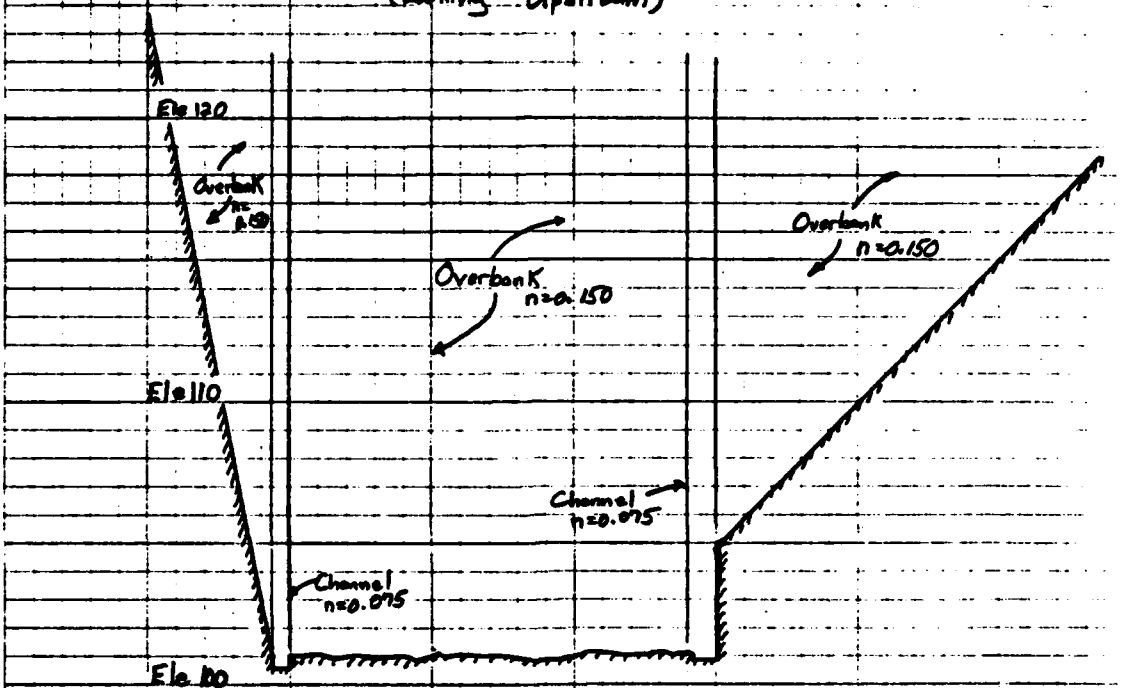
Tailwater at Dam

Cross-Section

(Looking Upstream)



Scale Horizontal 1" = 100'
Vertical 1" = 5'

Calculations: COE Stream backwater Method #1
& Manning Equation

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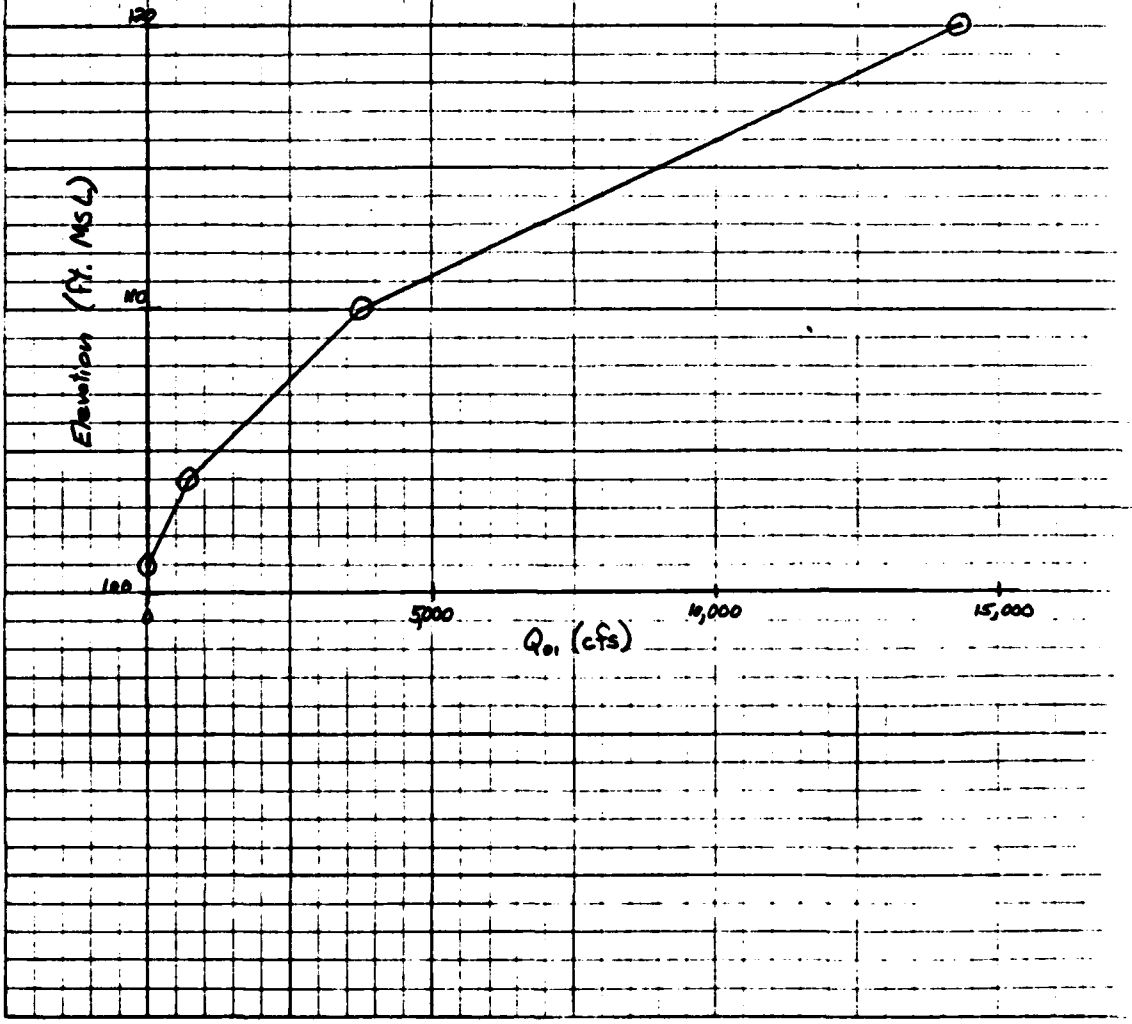
Elevation	Channel A	Channel WP	Channel R	Overbank A	Overbank WP	Overbank R	R_T	Equiv. Area	$AR^{2/3}$	Q_{01}
101	0									0
104	50	41	1.2	867	294	2.9	4.1	783	2006	854
110	157	41	3.7	2991	414	7.2	10.9	1784	8768	3733
120	322	41	7.9	8509	659	12.9	20.8	9452	33685	14340



500 cfs Distance from downstream section = 400'

Downstream WSE = 94.6
" S = 0.03
Try Ele 101.3
Q_{01} = 100 cfs
S = 0.0025
S_{ave} = 0.0163
h_f = 6.5
Ele = 101.1 close enough

WSE = 101.1

1000 cfs

Downstream WSE = 100.7
" S = 0.025

Try Ele = 105.5
Q_{01} = 1500 cfs
S = 0.00004
S_{ave} = 0.0125
h_f = 5.0
Ele = 105.7 close enough

2000 cfs

Downstream WSE = 101.6
" S = 0.025

Try WSE = 107.0
Q_{01} = 2250 cfs
S = 0.00008
S_{ave} = 0.0125
h_f = 5.0
Ele = 106.6 close enough

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For 5000 cfs

Downstream WSE = 110.0
" S = 0.0020

Try Ele = 110.4'
Q_{01} = 4200 cfs
S = 0.00014
S_{me} = 0.0011
h_c = 0.4

Ele = 110.4 close enough

For 8,000 cfs

Downstream WSE = 110.3
" S = 0.0033

Try Ele = 111.0
Q_{01} = 4800 cfs
S = 0.0023
S_{me} = 0.0018
h_c = 0.7'

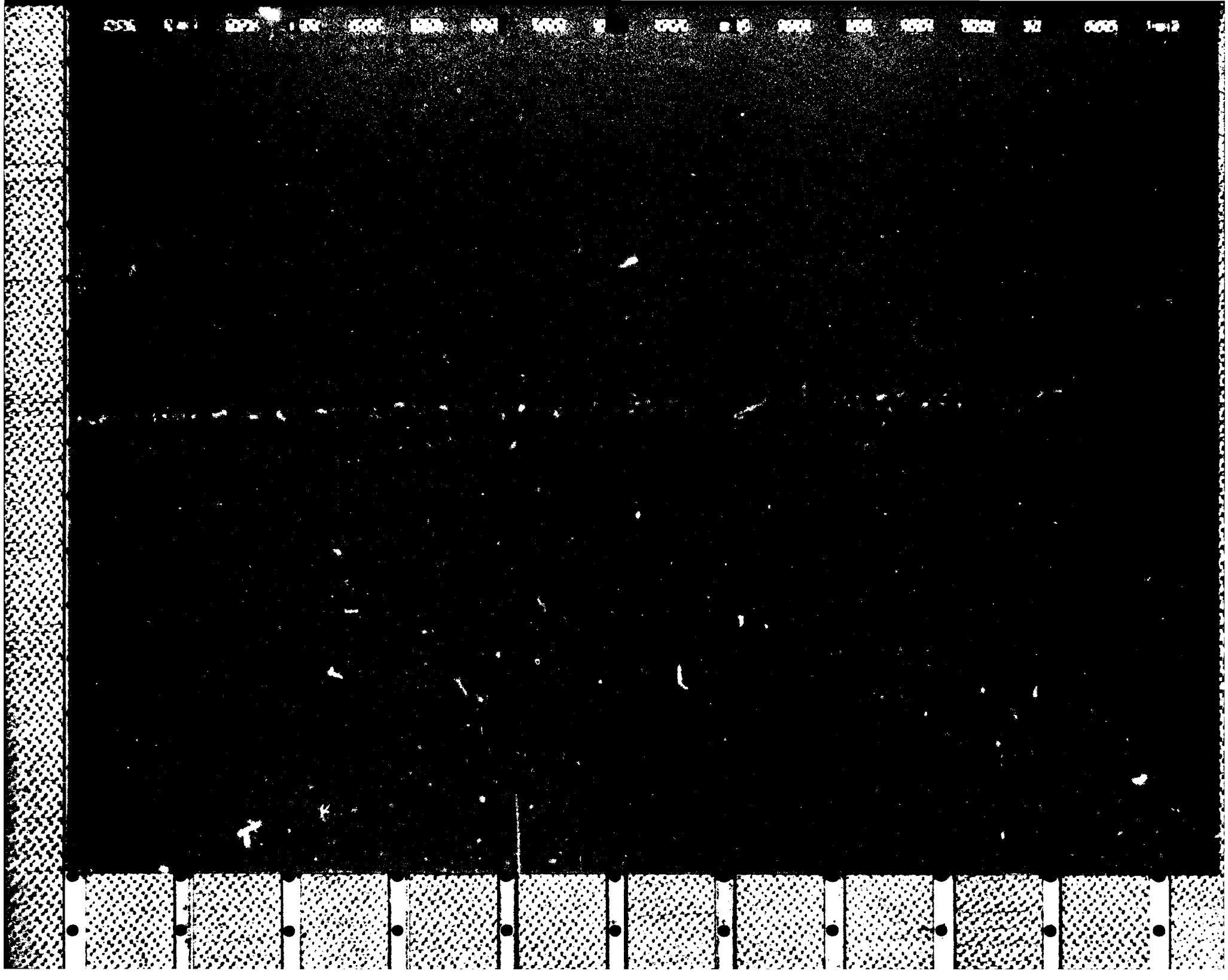
Ele = 111.0' close enough

For 10,000 cfs

Downstream WSE = 110.6
" S = 0.0040

Try Ele = 111.9
Q_{01} = 5100 cfs
S = 0.0064
S_{me} = 0.0022
h_c = 0.9

Ele = 111.5' close enough



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